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VOL. XXXI.

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REPORTS ON AN EXPLORATION OFF THE WEST COASTS OF MEXICO, CENTRAL AND SOUTH AMERICA, AND OFF THE GALAPAGOS ISLANDS, in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer "Albatross" during 1891, Lieut.-Commander Z. L. Tanner, U. S. N., Commanding. XXXII. The Panamic Deep Sea Echini. By Alexander Agassiz. pp. i–x, 1–243. 112 Plates, including a chart of the route, and 319 Figures in the text. November, 1904.

Memoirs of the Museum of Comparative Zoölogy

AT HARVARD COLLEGE.

Vol. XXXI.

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XXXII.

THE PANAMIC DEEP SEA ECHINI.

By ALEXANDER AGASSIZ.

ONE VOLUME TEXT,

WITH ONE HUNDRED AND TWELVE PLATES,

INCLUDING A CHART OF THE ROUTE, AND 319 FIGURES IN THE TEXT.

PLATES.

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CAMBRIDGE, U. S. A.:

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1904.

Plate A.

Plate A.

Phormosoma hispidum A. Ag.; 203 mm. in diameter, seen from the actinal side; Station 3413.

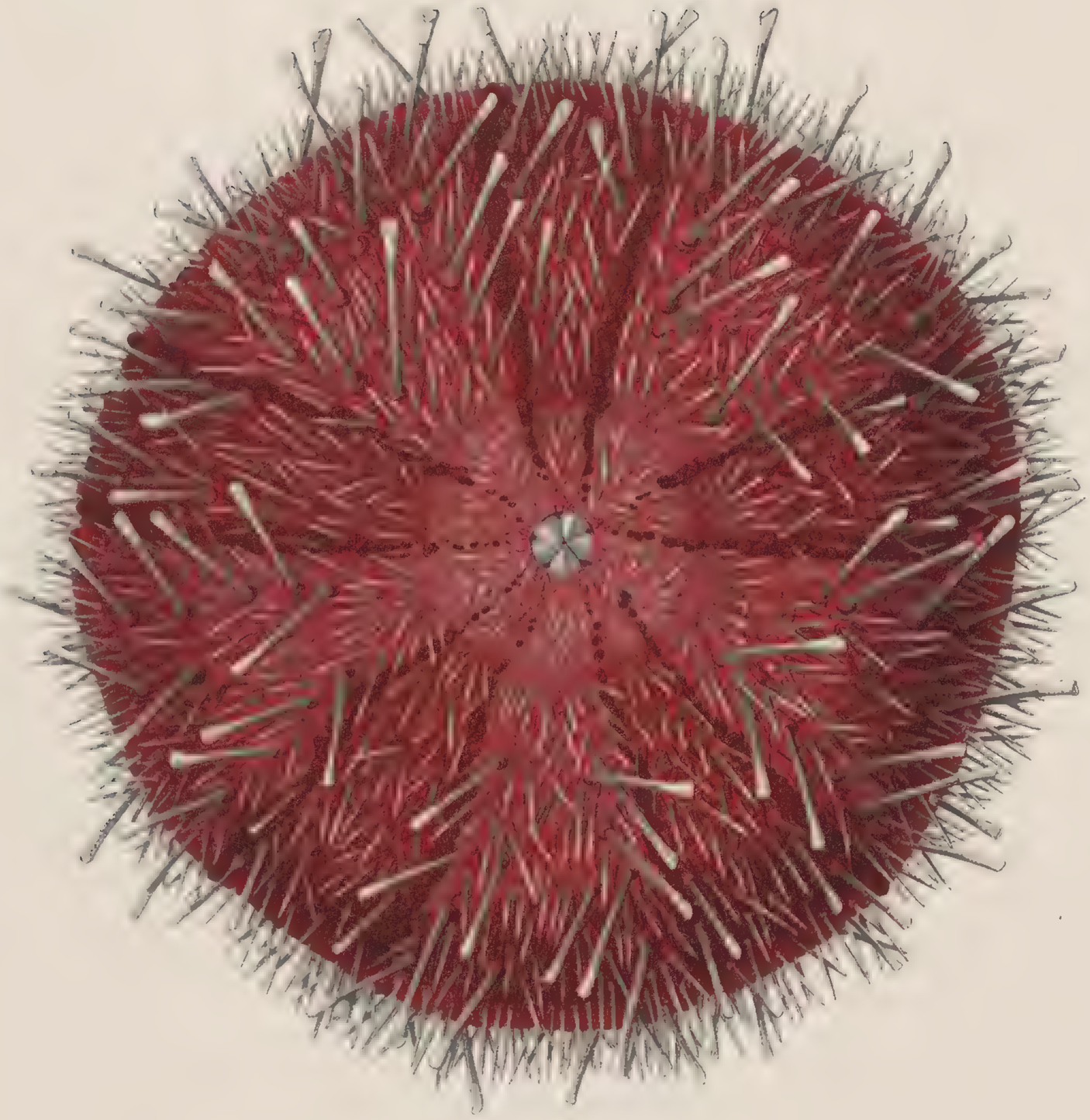

PLATE B.

Plate B.

1. **Phormosoma hispidum** A. Ag.; 54 mm. in length, seen from the actinal side, natural size; Station 3376.

2. **Pourtalesia Tanneri** A. Ag.; 17 mm. in length, seen in profile; Station 3431.

3. **Cystechinus Loveni** A. Ag.; 88 mm. in length, seen facing the right anterior lateral ambulacrum, natural size : Station 3415.

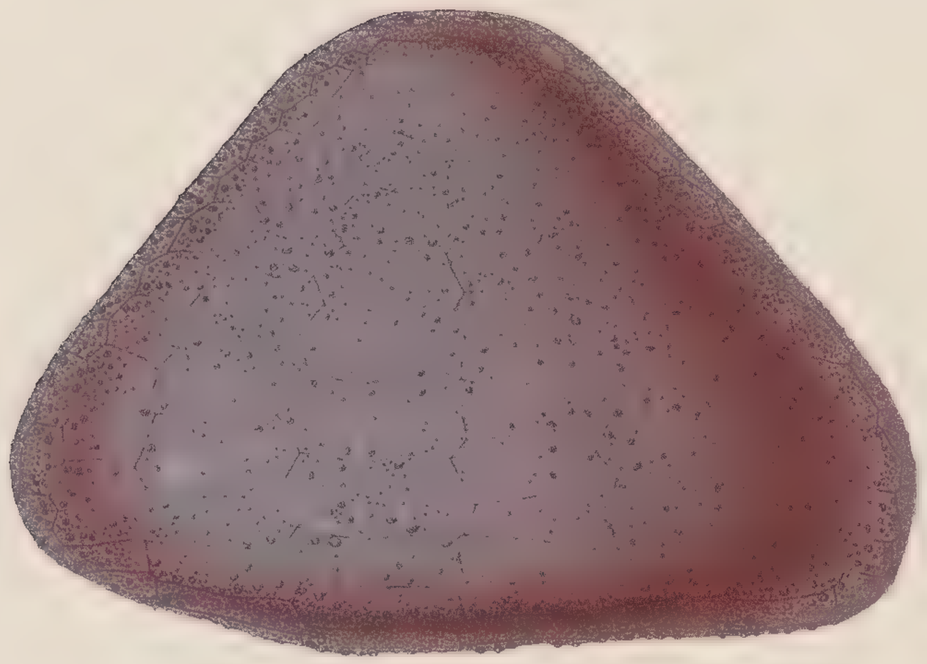

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PLATE 1.

Plate 1.

1–4. **Dorocidaris panamensis** A. Ag. ; all figures natural size.

In all the figures unless otherwise stated, the odd anterior ambulacrum occupies the centre of the upper part of the figures.

1. Seen from the abactinal side.

2. Seen from the actinal side, same specimen as fig. 1 ; figs. 1, 2, Station 3368.

3. A smaller specimen seen from the abactinal side.

4. Same as fig. 3, seen from the actinal side ; figs. 3, 4, Station 3367.

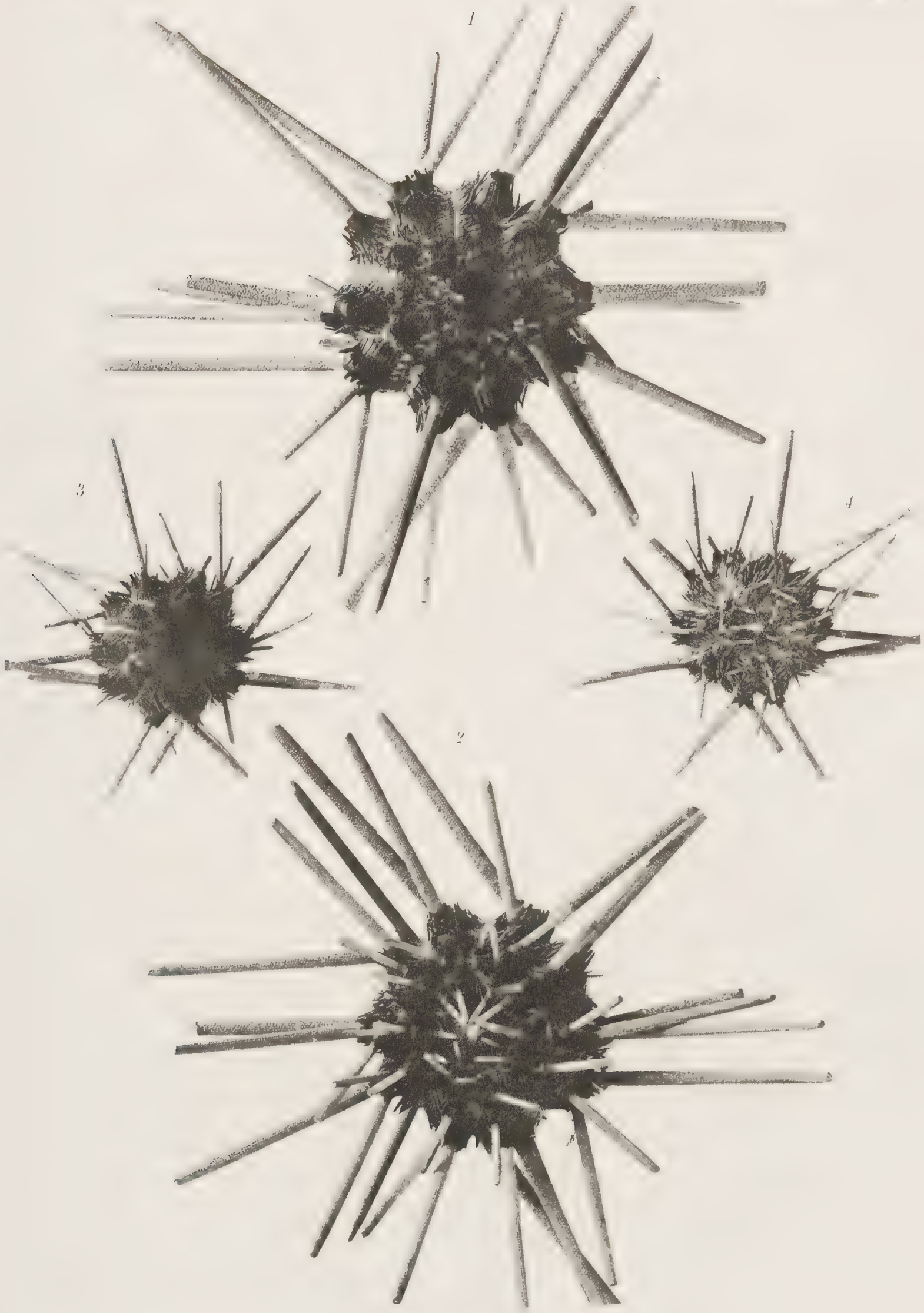
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PLATE 2.

Plate 2.

1–4. **Dorocidaris panamensis** A. Ag.; all figures natural size; Station 3368.

1. Seen from the abactinal side to show the denuded abactinal system, the odd anterior ambulacrum, and the left anterior interambulacrum and ambulacrum.

2. The same specimen, showing the same denuded parts of the test, seen from the actinal side.

3. The same specimen, seen in profile, showing part of the denuded test facing the left anterior interambulacrum.

4. The same specimen, seen in profile, showing part of the denuded test facing the odd anterior ambulacrum.

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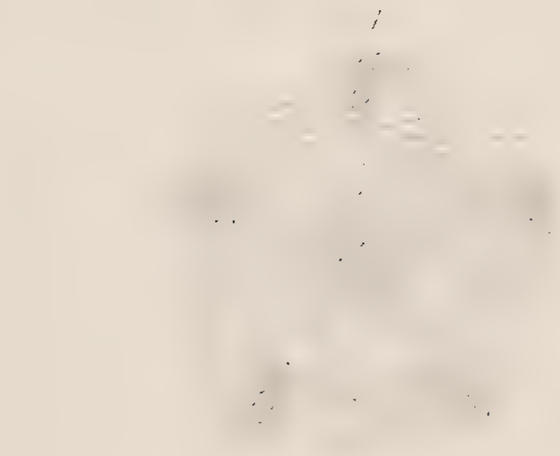
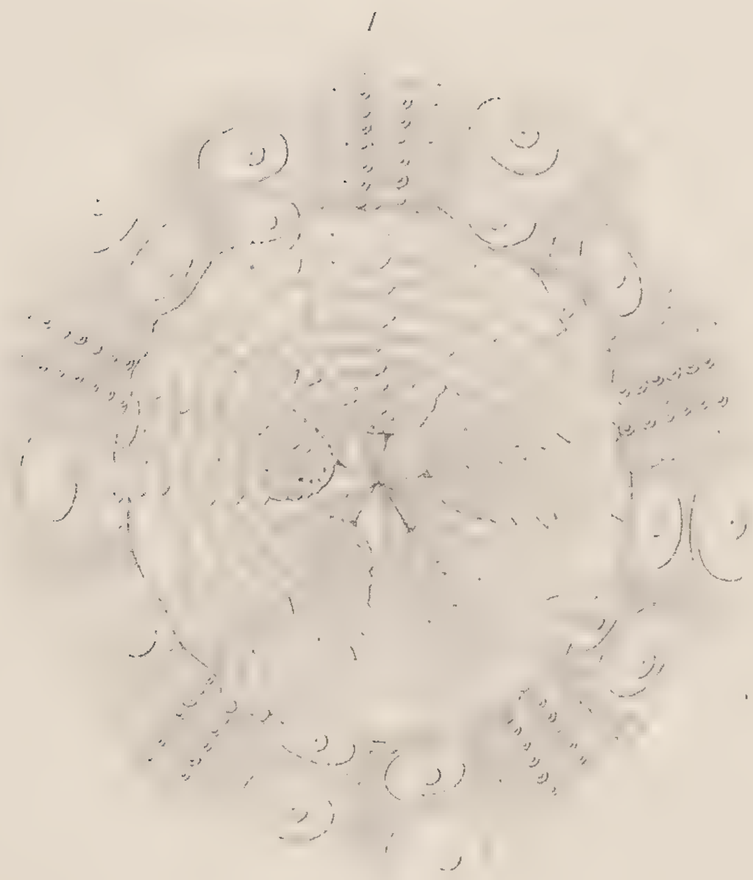
PLATE 3.

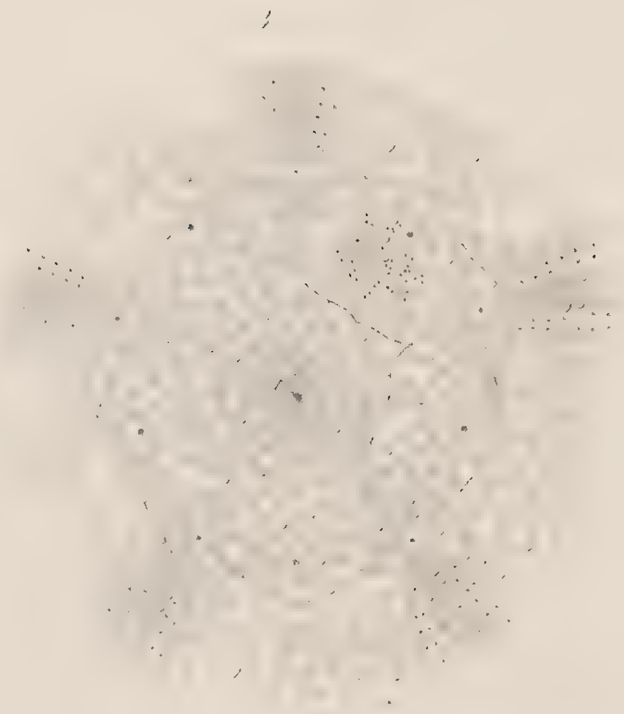
Plate 3.

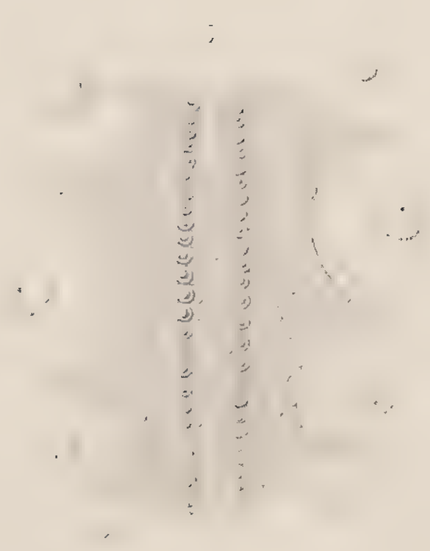
1–6. **Dorocidaris panamensis** A. Ag.; Station 3368.

1. Denuded abactinal system of a specimen measuring 10 mm. in diameter.
2. Denuded abactinal system of a specimen measuring 18 mm. in diameter.
3. Denuded abactinal system of a specimen having 7 primary coronal plates, measuring 30 mm. in diameter.
4. Denuded actinal system of the same specimen as fig. 3.
5. Part of test, seen facing the odd anterior ambulacrum; same specimen as fig. 3.
6. Part of test, seen facing the left anterior interambulacrum; same specimen as fig. 3.









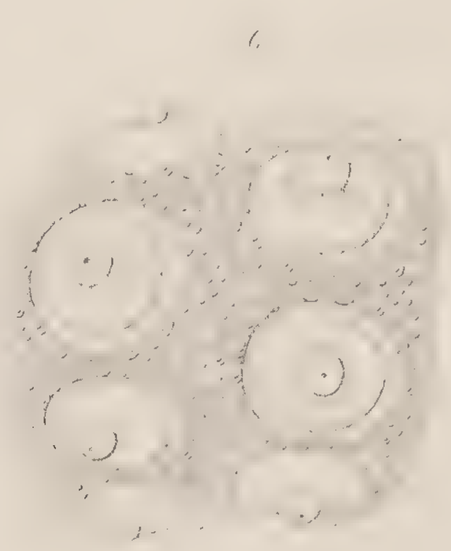


PLATE 4.

Plate 4.

1–12. Dorocidaris panamensis A. Ag.

1. Youngest left anterior interambulacral plate of specimen 30 mm. in diameter, showing the first trace of a primary tubercle; Station 3368.

2. Youngest posterior interambulacral plate more advanced than fig. 1; two lower secondary tubercles are developed, the primary and two upper tubercles in process of formation.

3. A genital plate with its opening protected on one side by long digitate tubercles; Station 3397.

4. Part of madreporic plate of specimen measuring 25 mm. in diameter.

5. Sixth posterior interambulacral plate from the actinostome of same specimen as fig. 4.

6. Genital plate with numerous pores, of specimen measuring 14 mm. in diameter; Station 3397.

7. Part of scrobicular area of primary tubercle, on sixth plate from the actinostome, left anterior interambulacral area of same specimen as fig. 1.

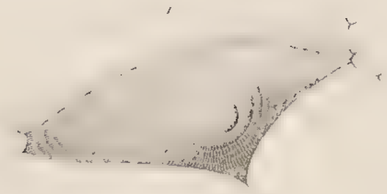
8. Primary left anterior interambulacral tubercle, on the fifth plate from the actinostome of same specimen as fig. 1.

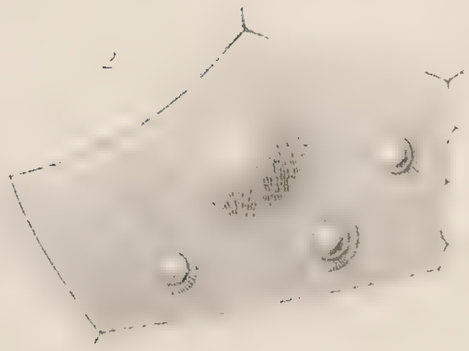
9. Radiole of primary interambulacral area of same specimen as fig. 1.

10. Primary interambulacral radiole of specimen measuring 20 mm. in diameter; Station 3397.

11. Primary interambulacral radiole of same specimen as fig. 10, with serrations modified into granules.

12. Slightly magnified granular structure of a primary interambulacral radiole of a specimen measuring 25 mm. in diameter; Station 3397.





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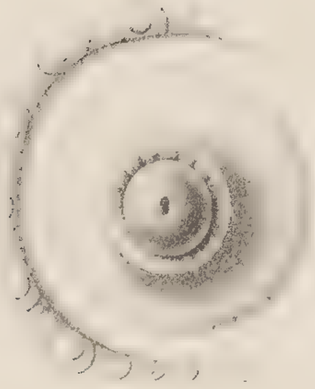

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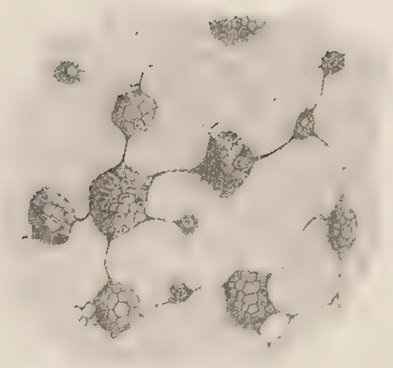

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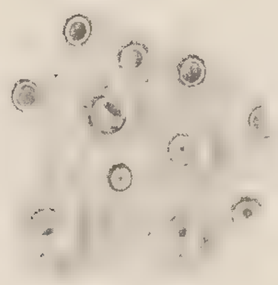
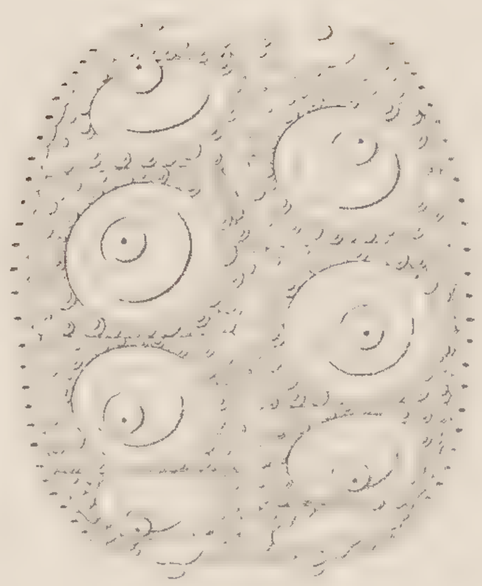


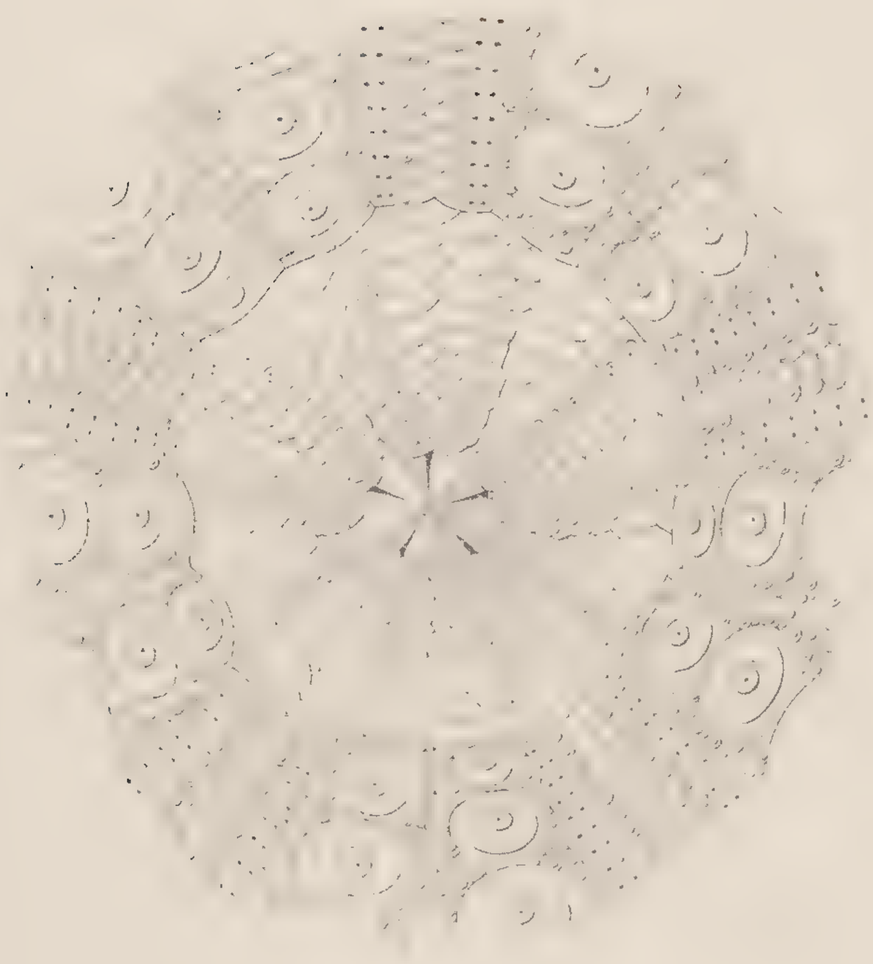
PLATE 5.

Plate 5.

1–4. **Centrocidaris Doederleini** A. Ag.; all figures from a specimen 26 mm. in diameter; Station 3369.

1. Actinal system.
2. Abactinal system.
3. Coronal plates seen facing the odd anterior ambulacrum, with 7 primary coronal plates.
4. Seen facing the left ambulacrum.





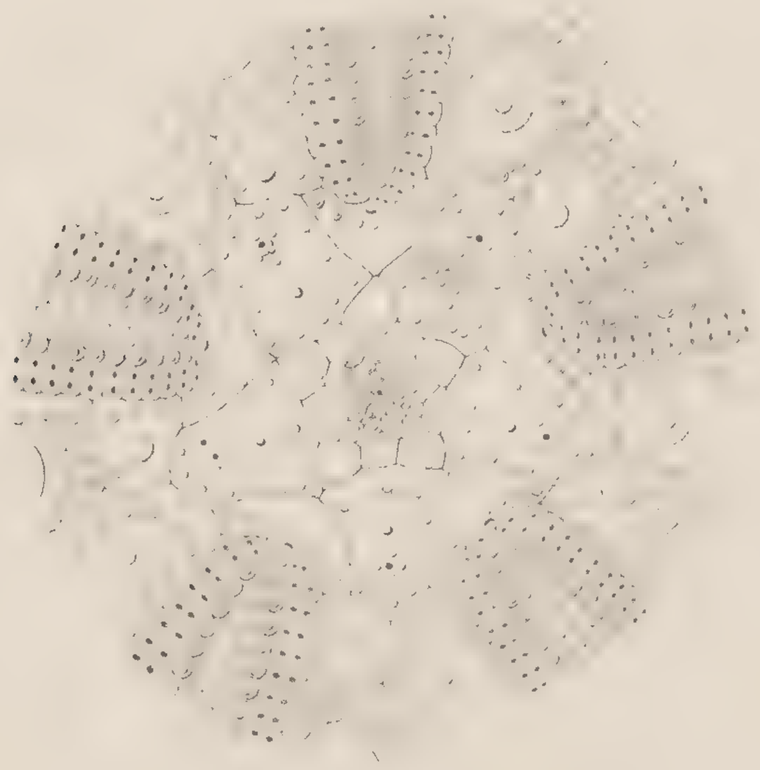


PLATE 6.

Plate 6.

1–4. **Porocidaris Milleri** A. Ag.; all figures natural size; Station 3381.

1. Seen from the actinal side.
2. Seen from the abactinal side.
3. Denuded test, showing the abactinal system of a female.
4. Denuded test, showing the abactinal system of a male.

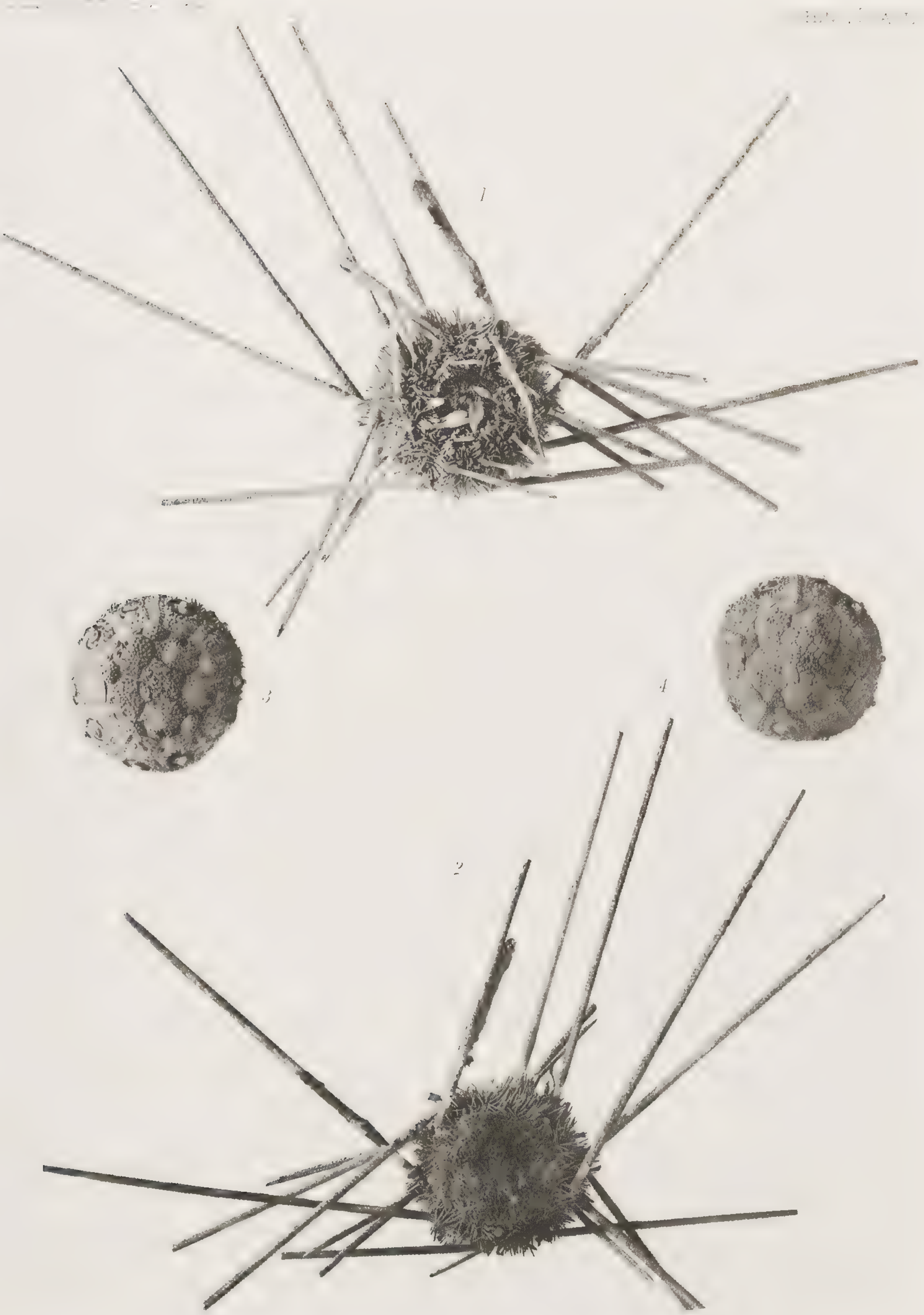
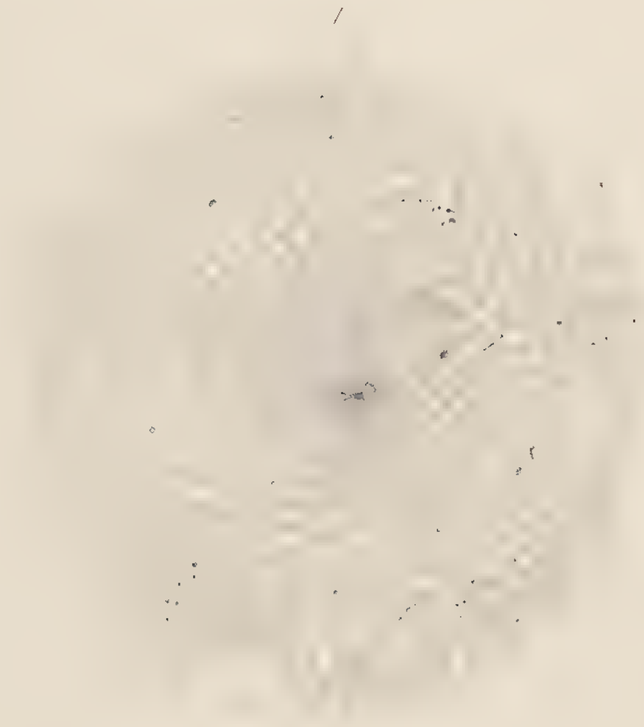


PLATE 7.

Plate 7.

1–7. Porocidaris Milleri A. Ag.

1. Abactinal system of a male measuring 28 mm. in diameter; Station 3381.
2. Abactinal system of a female measuring 28 mm. in diameter; Station 3381.
3. Abactinal system of a female measuring 20 mm. in diameter; Station 3399.
4. Abactinal system of a male measuring 18 mm. in diameter; Station 3399.
5. Abactinal system of a male measuring 14 mm. in diameter; Station 3399.
6. Actinal system of a specimen measuring 20 mm. in diameter, same as fig. 3; Station 3399.
7. Left anterior interambulacral plates adjoining actinal system of a specimen measuring 28 mm. in diameter; Station 3415.



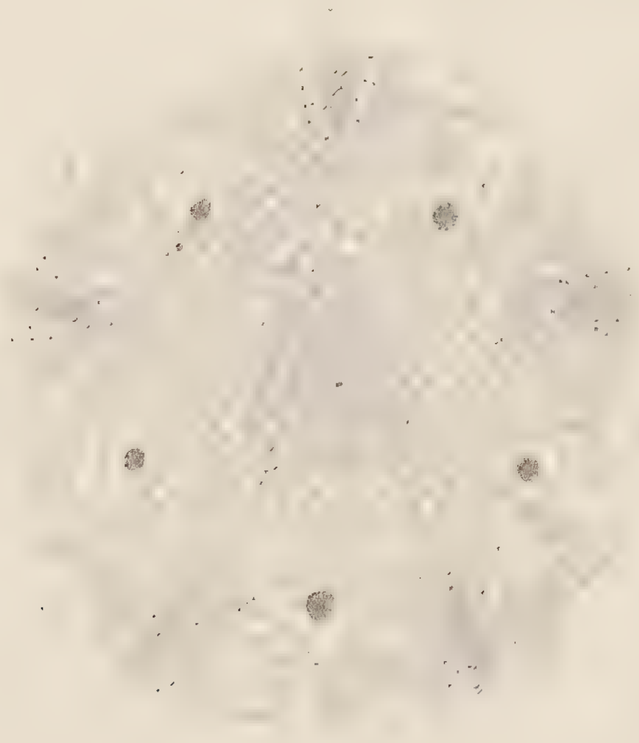


PLATE 8.

Plate 8.

1–9. Porocidaris Milleri A. Ag.

Figs. 1–3 show the formation of the new ambulacral plates below the ocular plates, seen from the interior of the test of a specimen 33 mm. in diameter ; Station 3415.

1. The odd ocular plate and young ambulacral plates.
2. The ocular plate of the right anterior ambulacrum.
3. The ocular plate of the left posterior ambulacrum.
4. The odd anterior ocular and the young ambulacral plates, seen from the exterior the same as fig. 1.
5. The actinal plates of the odd anterior ambulacrum with the adjoining buccal plates and surrounding interambulacral plates of a specimen 33 mm. in diameter.
6. Abactinal system of the same specimen as fig. 5, seen from the interior of the test, the anal system pushed to one side, and the left posterior genital split in two.
7. The fifth primary tubercle from the actinal system in the right posterior interambulacrum, specimen 28 mm. ; Station 3381.
8. The auricles of the right anterior ambulacrum, seen from the interior of the test, same specimen as fig. 7.
9. The same as fig. 8, seen from the exterior.

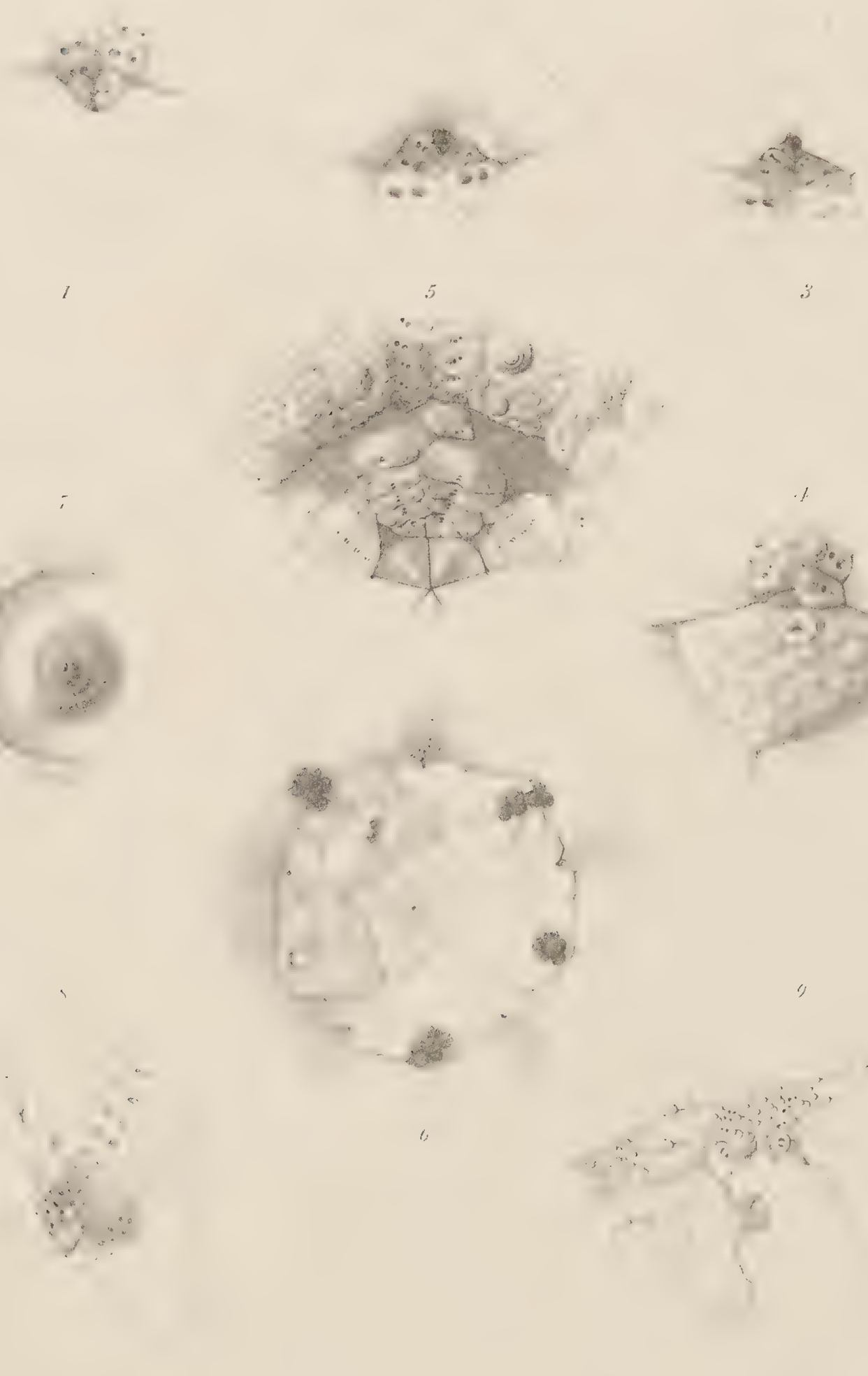

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PLATE 9.

Plate 9.

1–6. **Podocidaris Cobosi** A. Ag.; natural size; Station 3404.

1. Seen in profile.
2. The same, seen from the abactinal side.
3. The same, seen from the actinal side.
4. Partly denuded test, showing the abactinal system.
5. Partly denuded test, seen facing the right posterior ambulacrum.
6. Same as fig. 4, seen facing the left anterior interambulacrum.

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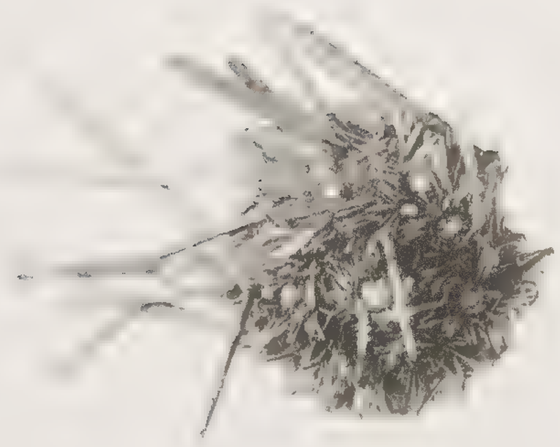

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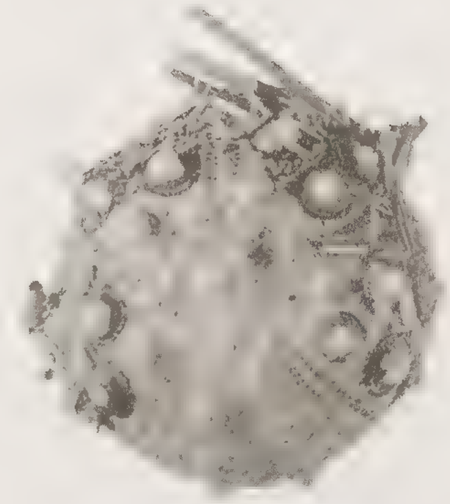

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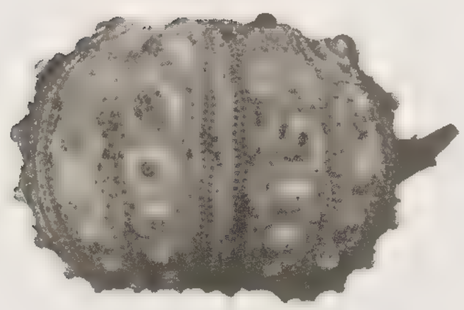

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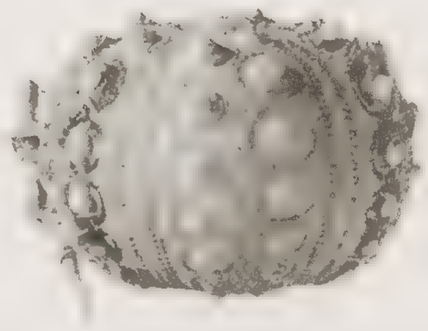

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PLATE 10.

Plate 10.

1–3. **Porocidaris Milleri** A. Ag.

1. Seen facing the odd anterior ambulacrum of specimen measuring 20 mm., having 5 primary coronal plates, from Station 3399. Same as Pl. 7, figs. 3, 6.

2. Same as fig. 1, seen facing the left anterior interambulacrum.

3. Lower part of primary interambulacral radiole of specimen measuring 33 mm. in diameter; Station 3415.

4–9. **Porocidaris Cobosi** A. Ag.; Station 3404.

4. Seen facing the odd anterior ambulacrum of a specimen having 5 primary coronal plates, measuring 8 mm. in diameter.

5. Seen facing the left anterior interambulacrum, same specimen as fig. 4.

6. Seen facing the odd anterior ambulacrum of a specimen having 6 primary coronal plates measuring 21 mm. in diameter. The artist has omitted the lines joining the pores, as in figs. 1, 2, 4, 8.

7. Seen facing the left anterior interambulacrum of the same specimen as fig. 6.

8. Seen facing the odd anterior ambulacrum of a specimen having 7 primary coronal plates and measuring 35 mm. in diameter.

9. Seen facing the left anterior interambulacrum of the same specimen as fig. 8.

The lines joining the pores have been omitted in figs. 5, 7, 9.

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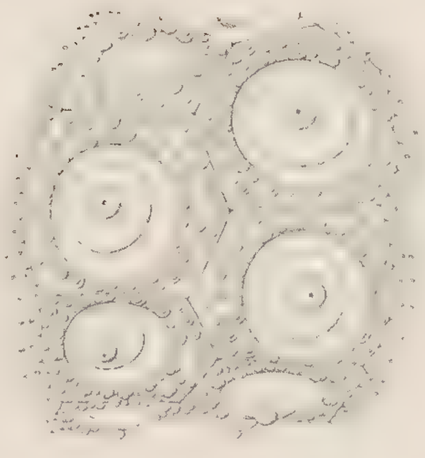

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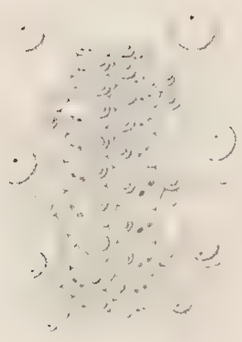

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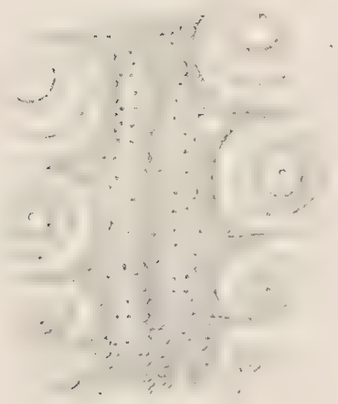

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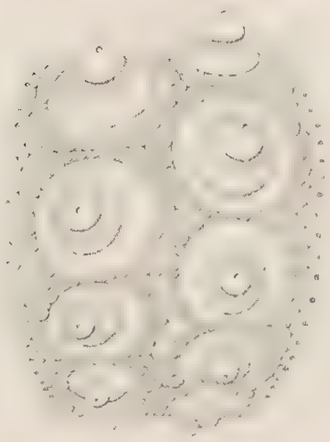

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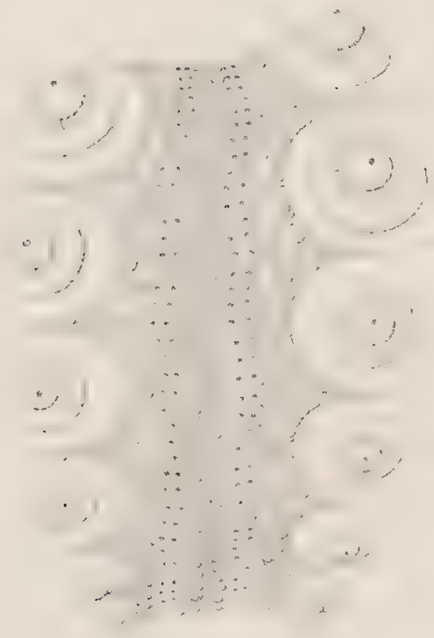

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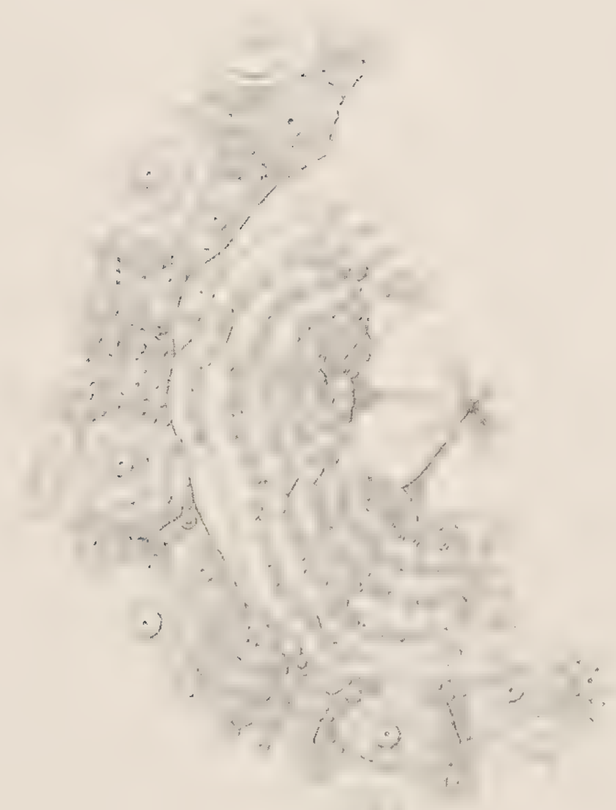
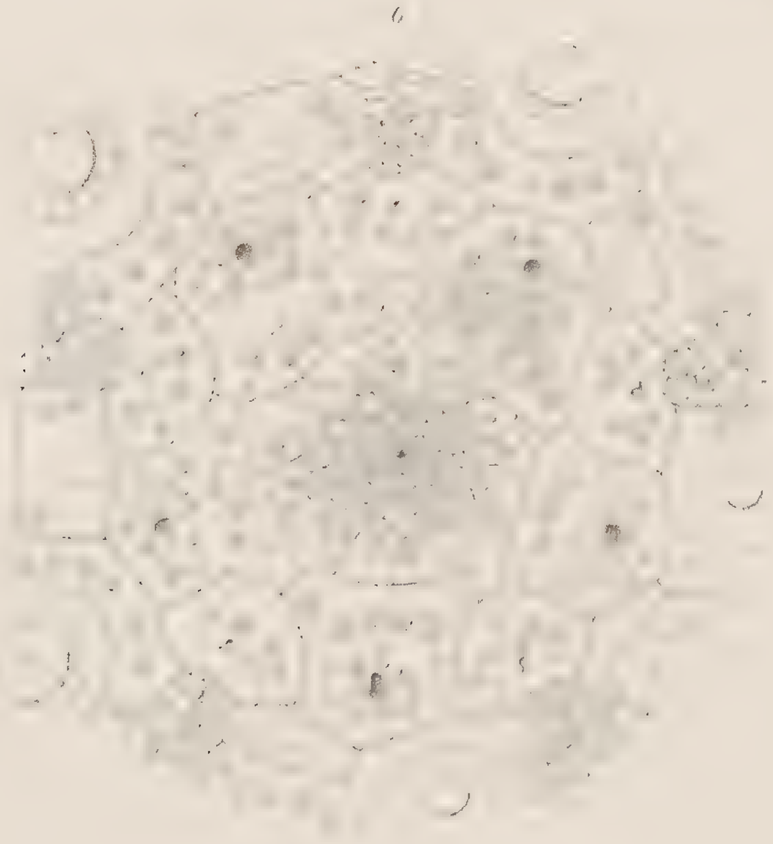
PLATE 11.

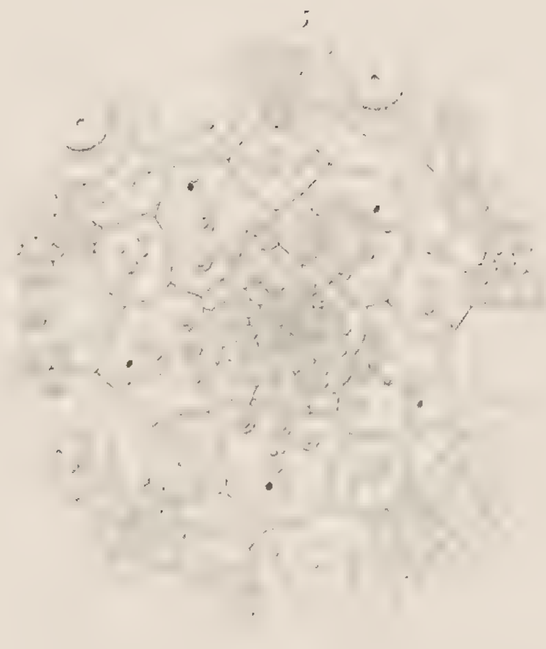
Plate 11.

1–6. **Porocidaris Cobosi** A. Ag.; Station 3404.

1. Part of denuded actinal system of specimen measuring 35 mm. in diameter.
2. Denuded actinal system of specimen measuring 21 mm. in diameter.
3. Coronal plates surrounding part of the actinal system of a specimen measuring 18 mm. in diameter, seen from the exterior.
4. The same as fig. 3, seen from the interior, showing the low auricles and the peculiar prolongations of the actinal plates.
5. Abactinal system of a male, same as fig. 2.
6. Abactinal system of a female, same as fig. 1.







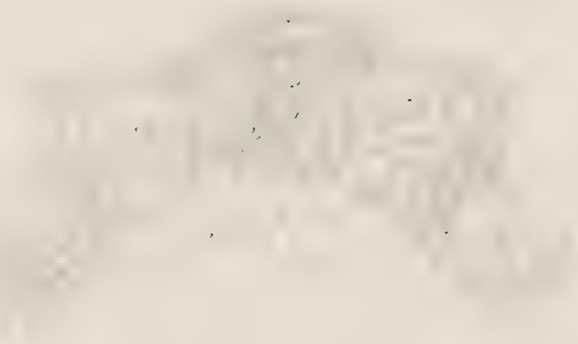


PLATE 12.

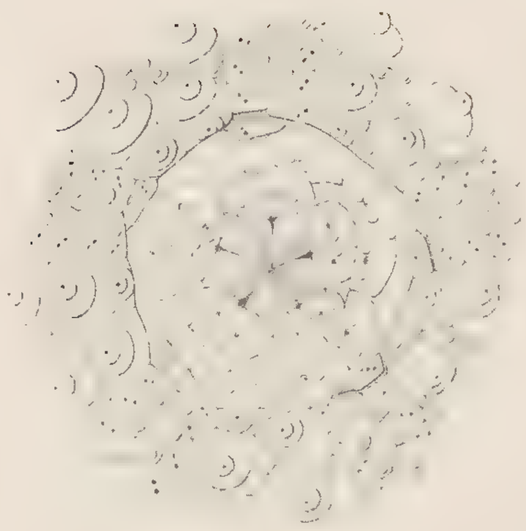
Plate 12.

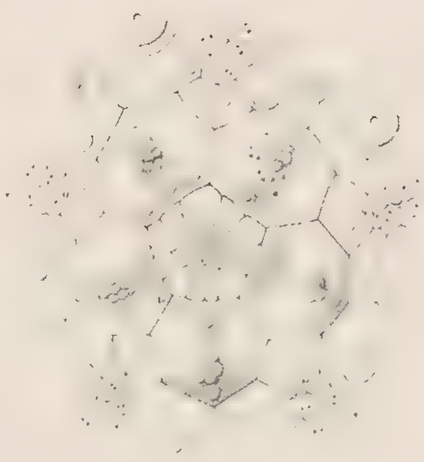
1–12. **Porocidaris Cobosi** A. Ag.; Station 3404.

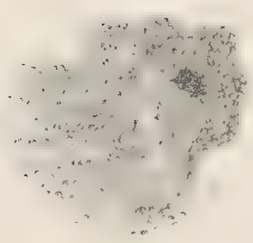
1. Abactinal system of specimen measuring 8 mm. in diameter.
2. Actinal system of the same specimen as fig. 1.
3. Part of actinal system of specimen measuring 10 mm. in diameter.
4. Showing resorption of odd and right anterior interambulacral plates adjoining actinostome, same specimen as fig. 1.
5. Right anterior ambulacral plate showing pore and secondary tubercle of same specimen as fig. 1.
6. Showing resorption of right and left posterior ambulacral and odd posterior interambulacral plates adjoining the actinostome in specimen measuring 21 mm. in diameter.
7. Showing the same in a specimen measuring 35 mm. in diameter.
8. Abactinal extremity of the left posterior ambulacrum, seen from the interior, showing the broad gap left between the ocular and the interambulacral plates, held together by thin calcareous threads.

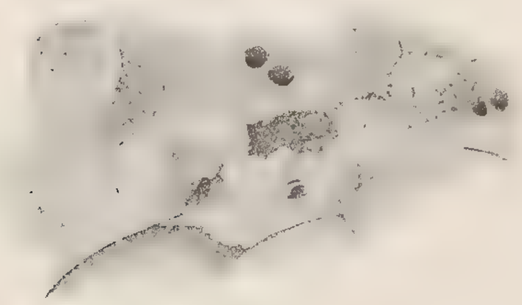
9–11. Papillæ covering the genital openings of specimens measuring 10 mm. (figs. 9, 11) and 21 mm. in diameter (fig. 10).

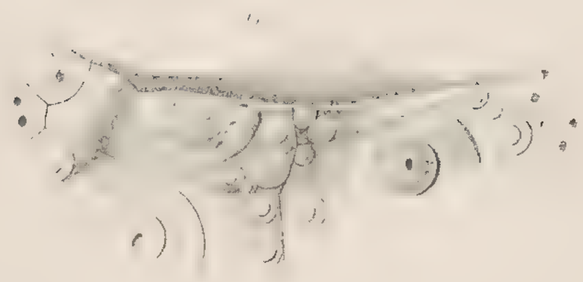
12. Primary spine of specimen measuring 35 mm.











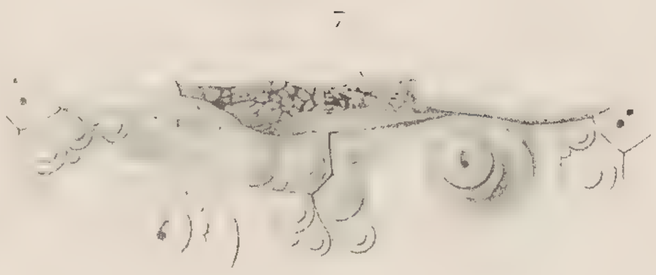


PLATE 13.

Plate 13.

1–4. **Porocidaris Cobosi** A. Ag.; Station 3404.

1. Showing the modification of the miliaries of an odd posterior interambulacral plate from the attachment of the muscles of the base of the spine in specimen measuring 35 mm. in diameter.

2. Primary tubercle of the sixth interambulacral plate from the actinostome, the same specimen as fig. 1.

3. Last interambulacral plate of the left anterior interambulacrum, showing the piling up of the calcareous tissue to form the primary tubercle; the more solid perforated part may be the mammelon.

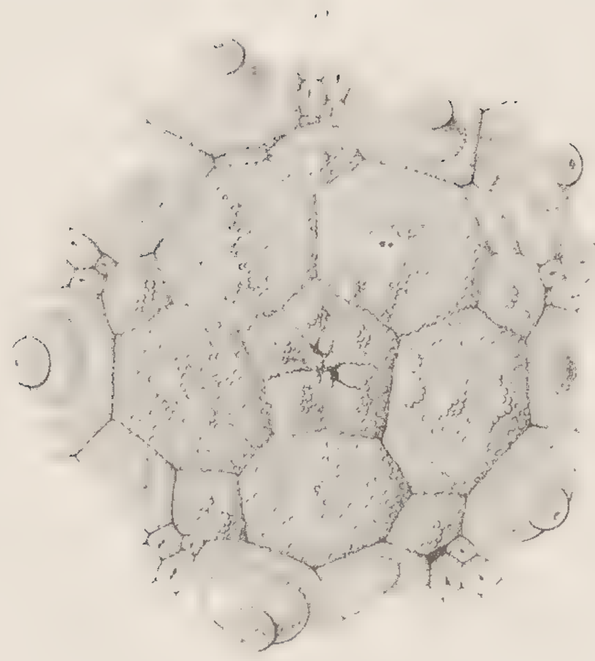
4. Shows the mode of growth of the calcareous tissue of the test laid up in strata, with the thin calcareous threads extending to the abactinal system, exterior view.

5. **Dorocidaris papillata** A. Ag.

5. Abactinal system of young specimen 2.8 mm. in diameter, dredged off Key West in 138 fms.

6. **Goniocidaris canaliculata** A. Ag.

6. Part of abactinal system of young specimen measuring 1.5 mm. in diameter. "Challenger," Station 844, shows the five genital plates, one of which is the madreporic genital.



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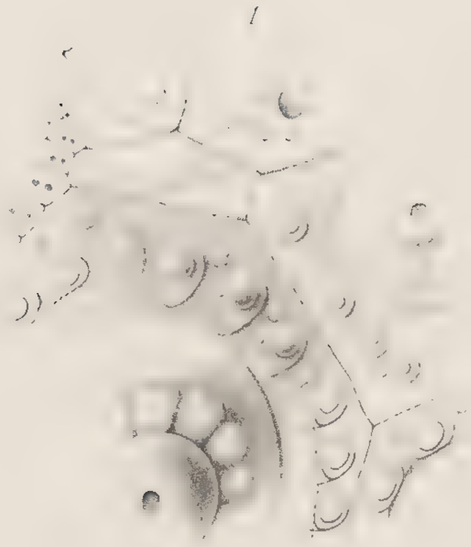

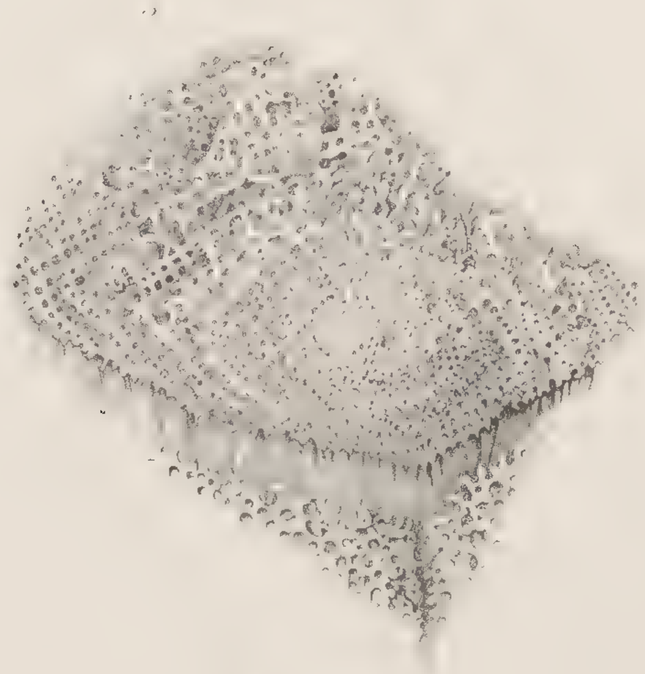

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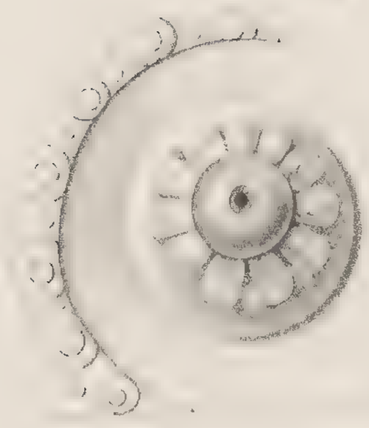

PLATE 14.

Plate 14.

1–2. **Centrocidaris Doederleini** A. Ag.; Station 3369.

1. Seen from the actinal side, partly denuded, showing the right anterior interambulacrum and the adjoining ambulacra.

2. The same as fig. 1, showing the abactinal system.

3–11. **Salenia miliaris** A. Ag.

3. Partly denuded test, seen from the actinal side; Station 3413.

4. The same as fig. 3, seen from the abactinal side.

5. The same as fig. 3, seen facing the odd interambulacrum.

6. Another specimen with a high test, seen from the actinal side; Station 3360.

7. The same as fig. 6, seen from the abactinal side.

8. The same as fig. 6, seen facing the left anterior ambulacrum.

9. A small specimen, seen from the actinal side; Station 3360.

10. The same as fig. 9, seen from the abactinal side.

11. The same as fig. 10, seen facing the left anterior ambulacrum.

All figures natural size.

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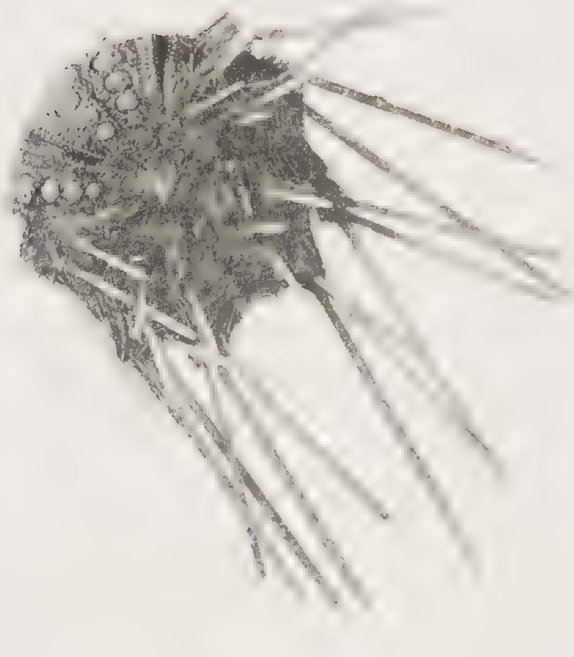

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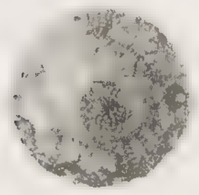

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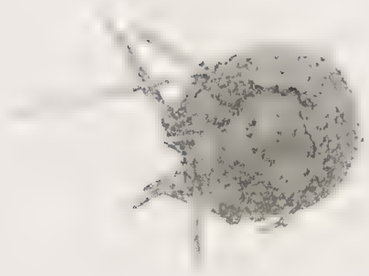

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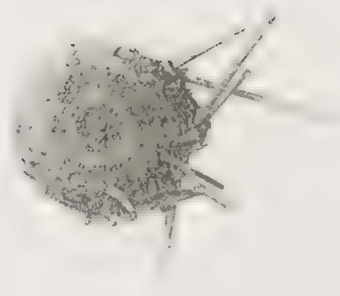

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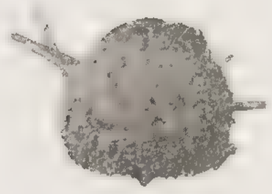

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PLATE 15.

Plate 15.

1–2. **Salenia miliaris** A. Ag.; Station 3413.

1. Seen from the actinal side, the right posterior interambulacrum occupies the upper central part of the figure.

2. The same as fig. 1, seen from the abactinal side; the position of the test is the same.

3–5. **Dialithocidaris gemmifera** A. Ag.; Station 3382.

3. Seen from the actinal side.

4. Seen from the abactinal side.

5. Seen facing the odd anterior ambulacrum.

All figures natural size.

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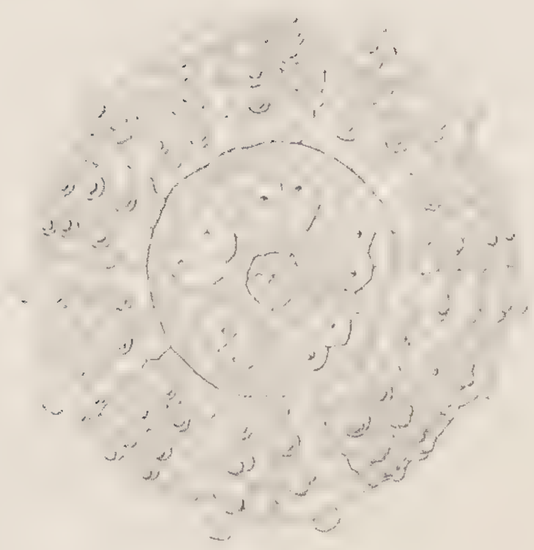
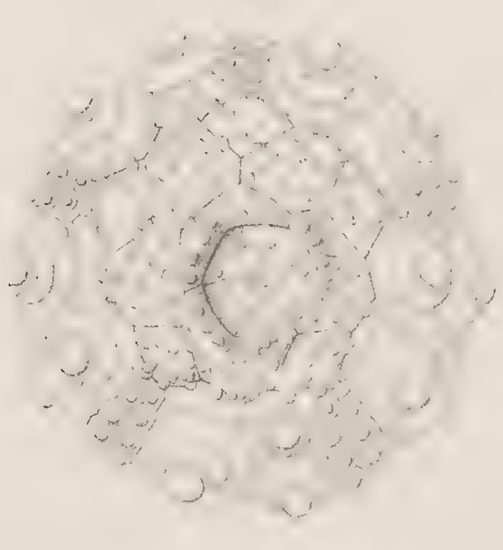
PLATE 16.

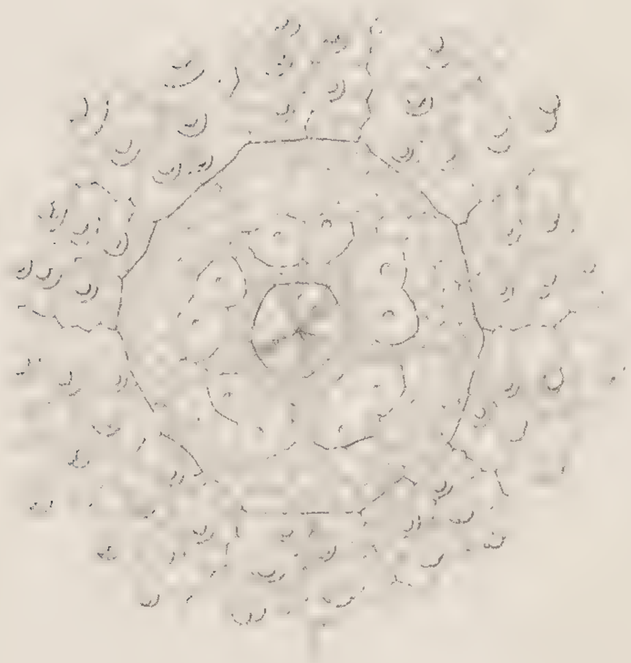
Plate 16.

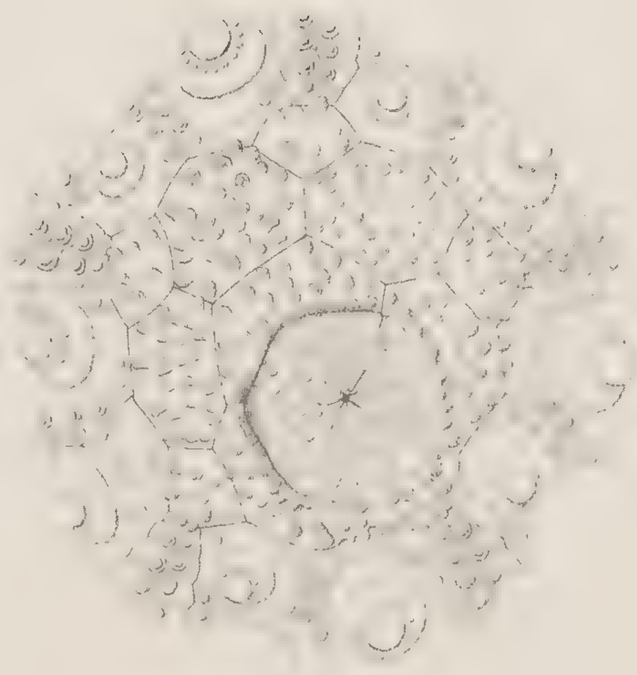
1–6. **Salenia miliaris** A. Ag.

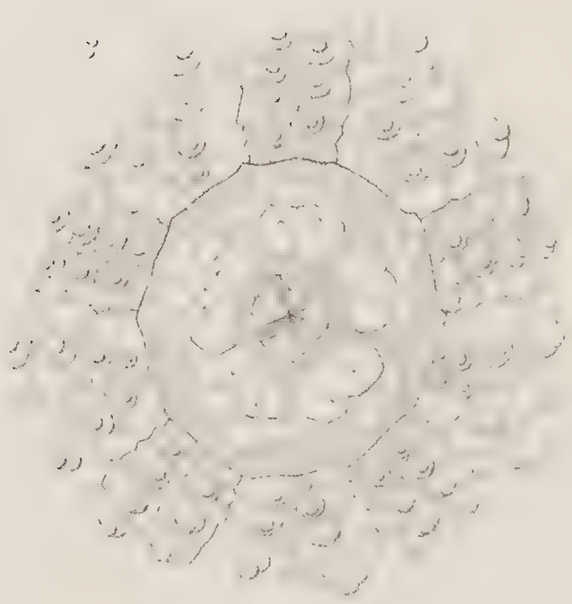
1. Seen from the actinal side, 5 mm. in diameter; Station 3380.
2. The same as fig. 1, seen from the abactinal side.
3. Actinal system of specimen measuring 8 mm. in diameter; Station 3407.
4. The same as fig. 3, showing the abactinal system.
5. Actinal system of a specimen measuring 10 mm. in diameter; Station 3362.
6. The same as fig. 5, showing the abactinal system.











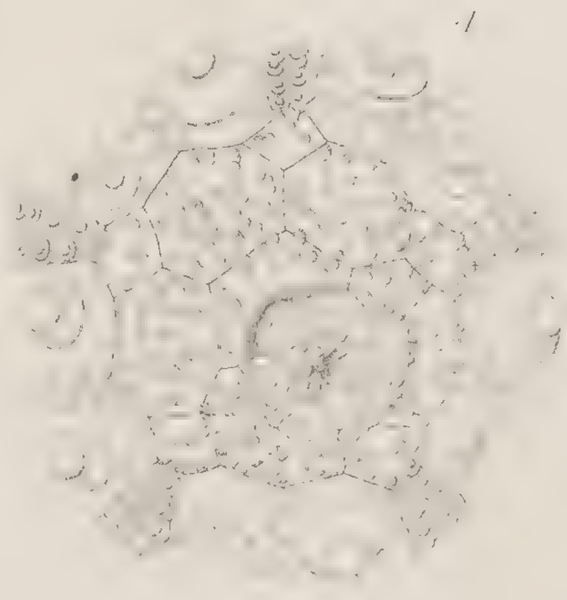


PLATE 17.

Plate 17.

1–7. Salenia miliaris A. Ag.

1. Actinal system of specimen measuring 13 mm. in diameter; Station 3360.
2. The same as fig. 1, seen from the abactinal side.
3. Abactinal system of specimen measuring 16 mm. in diameter; Station 3413.
4. Seen facing the odd anterior ambulacrum of a specimen measuring 5 mm. in diameter, with 5 primary tubercles, same as Pl. 16, figs. 1, 2; Station 3380.
5. The same as fig. 4, seen facing the left anterior interambulacrum.
6. The same specimen as Pl. 16, figs. 3, 4, measuring 8 mm. in diameter, with 5 primary tubercles seen facing the odd anterior ambulacrum; Station 3407.
7. The same as fig. 6, seen facing the left anterior ambulacrum.

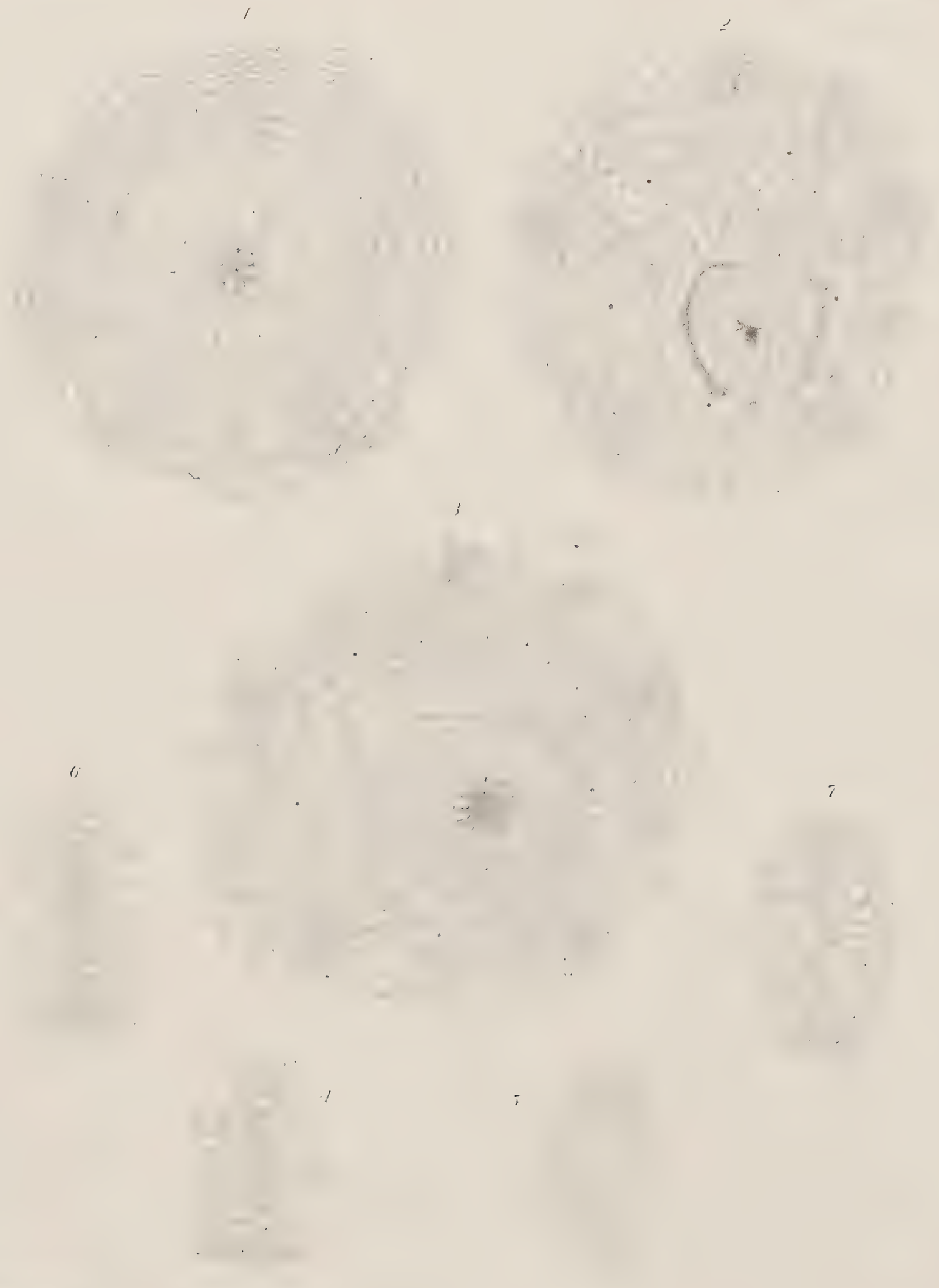


PLATE 18.

Plate 18.

1–6. **Salenia miliaris** A. Ag.

1. The same specimen as Pl. 16, figs. 5, 6, Station 3362, measuring 10 mm. in diameter, seen facing the odd anterior ambulacrum with 5 adjoining primary interambulacral tubercles.

2. The same as fig. 1, seen facing the left anterior interambulacrum.

3. The same specimen as Pl. 17, figs. 1, 2, Station 3360, measuring 13 mm. in diameter, seen facing the odd anterior ambulacrum, with 7 and 6 adjoining primary interambulacral tubercles.

4. The same as fig. 6, seen facing the left anterior interambulacrum.

5. Seen facing the odd anterior ambulacral area of a specimen measuring 17 mm. in diameter, with 7 and 8 adjoining primary interambulacral tubercles; Station 3360.

6. The same as fig. 5, seen facing the left anterior interambulacrum.

PLATE 19.

Plate 19.

1–8. Salenia miliaris A. Ag.

1. Part of the actinal system of the same specimen as Pl. 17, fig. 3, measuring 16 mm. in diameter; Station 3413.

2. Spheridia at actinostome of left anterior ambulacrum of specimen measuring 15 mm. in diameter; Station 3362.

3. The third plate from the actinostome of the right anterior interambulacrum of specimen of Pl. 17, figs. 1, 2, measuring 13 mm.; Station 3360.

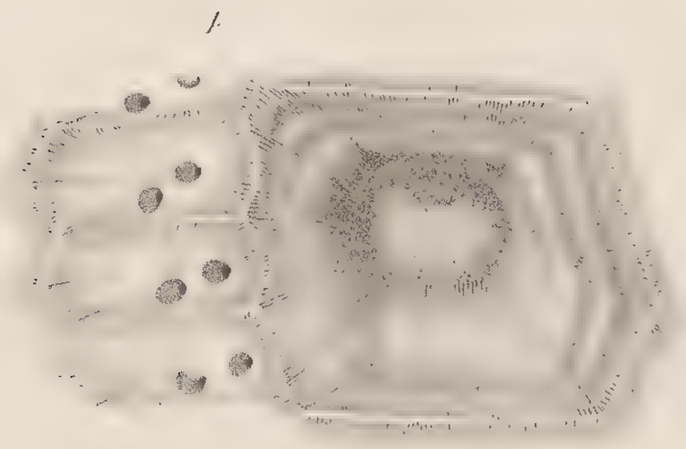
4. Showing the striated structure of the interior of a primary plate (the third plate from the actinostome) of the right anterior interambulacrum with the adjoining plates of the odd ambulacrum of the same specimen as Pl. 17, fig. 3, measuring 16 mm. in diameter; Station 3413.

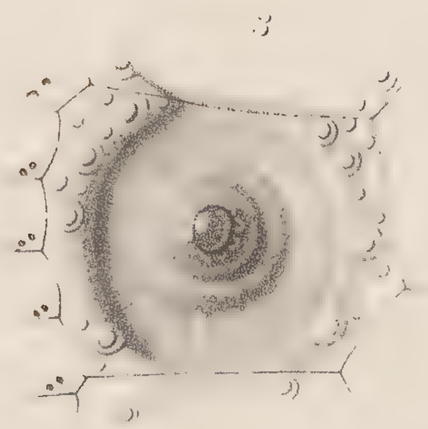
5. Showing the striated structure of primary interambulacral plate of the odd posterior interambulacrum of same specimen as fig. 2, seen from the interior.

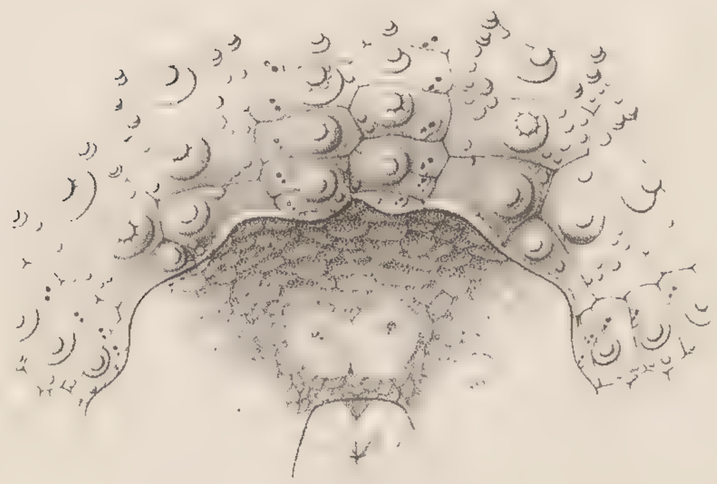
6. Section across the fifth primary interambulacral tubercle of same specimen as fig. 2.

7. Lower part of primary interambulacral radiole from specimen measuring 14 mm. in diameter; Station 3413.

8. Upper part of the same spine.







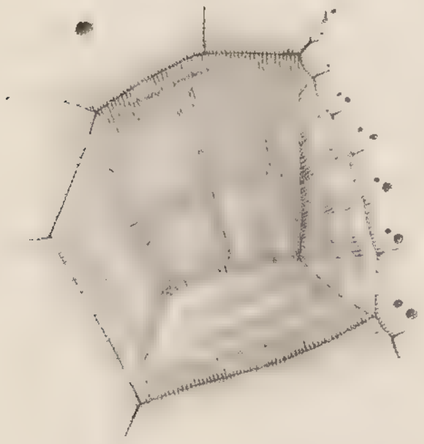


PLATE 20.

Plate 20.

1–4. **Salenia miliaris** A. Ag.

1. Odd anterior ambulacrum of specimen, Pl. 16, figs. 1, 2, Pl. 17, figs. 4, 5, measuring 5 mm. in diameter; Station 3380.

2. Odd anterior ambulacrum of specimen, Pl. 16, figs. 3, 4, Pl. 17, figs. 6, 7, measuring 8 mm. in diameter; Station 3407.

3. Odd anterior ambulacrum of specimen, Pl. 17, figs. 1, 2, Pl. 18, figs. 3, 4, measuring 13 mm. in diameter; Station 3360.

4. Actinal part of the odd anterior ambulacrum of specimen, Pl. 17, fig. 3, Pl. 19, fig. 1, measuring 16 mm. in diameter; Station 3413.

5–7. **Salenia Pattersoni** A. Ag.

5. Right posterior ambulacrum of specimen measuring 5 mm. in diameter; "Blake" Exp. off Havana.

6. Odd anterior ambulacrum of specimen measuring 10 mm. in diameter.

7. Actinal part of odd anterior ambulacrum of specimen measuring 13 mm. in diameter.

8. **Salenia hastigera** A. Ag.

8. Actinal part of odd anterior ambulacrum of specimen measuring 13 mm. in diameter; "Challenger" Exp. Station 195.

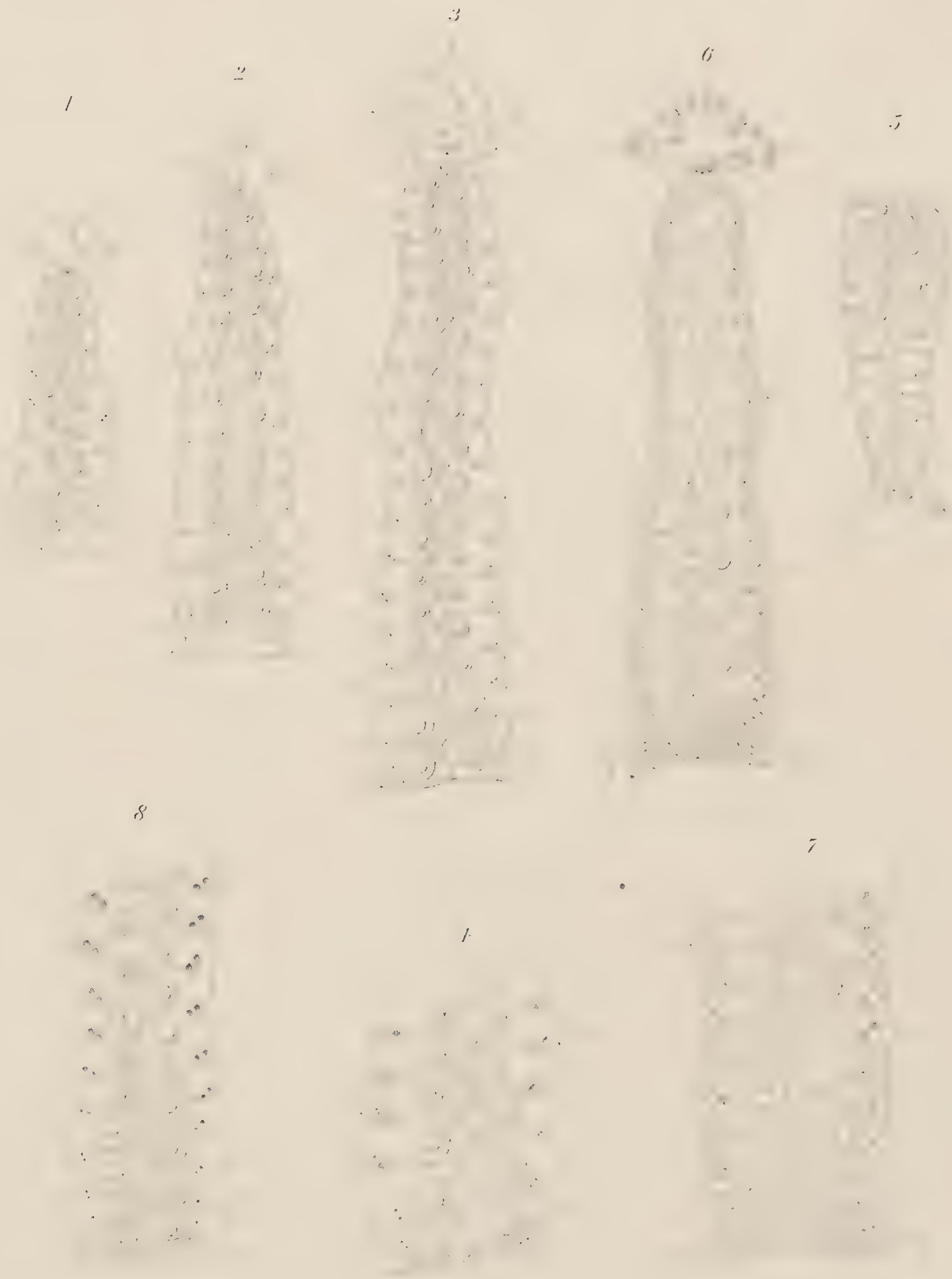

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PLATE 21.

PLATE 21.

1–9. **Salenia varispina** A. Ag.

1. Specimen measuring 1.9 mm. in diameter, seen from the actinal side; off Double Headed Shot Keys, 315 fms.

2. The same, seen from the abactinal side.

3. The same, in profile, facing the left posterior interambulacrum.

4. Buccal plates of the right posterior ambulacrum of the same specimen.

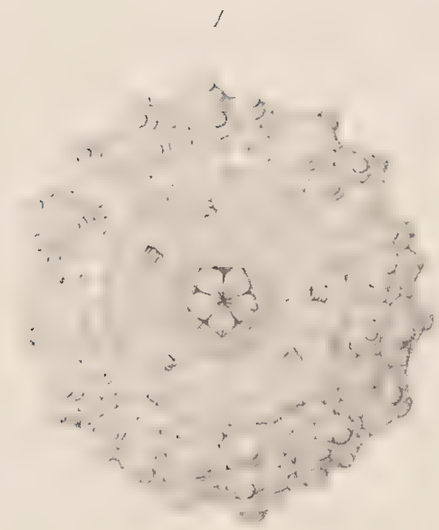
5. The odd anterior ambulacrum of the same specimen, with 5 and 4 ambulacral plates and 4 primary interambulacral plates.

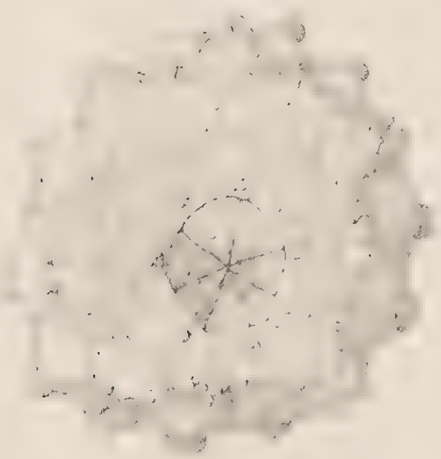
6. The odd anterior ambulacrum of a specimen measuring 5 mm. in diameter, with 7 and 6 primary interambulacral plates; "Blake" Exp. Station 288, off Barbados 399 fms.

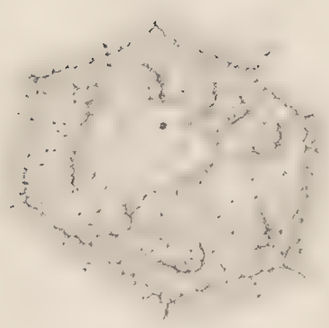
7. Right anterior genital plate of same specimen as fig. 1, from the exterior; the pores of the madreporic body are not yet developed.

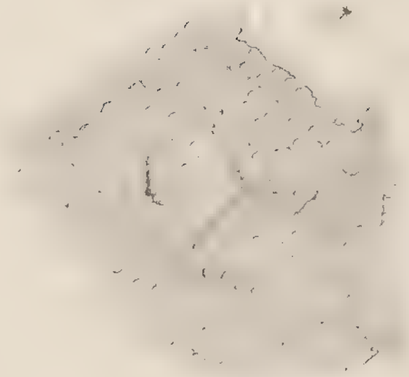
8. Inner view of the same plate as fig. 7.

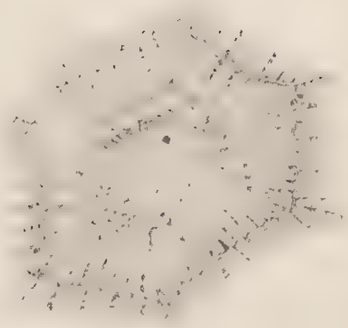
9. Anal system of same specimen as fig. 6.











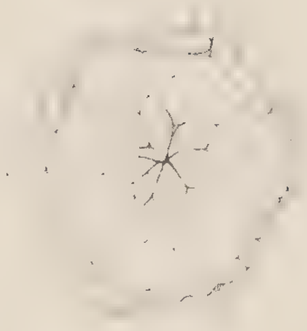


PLATE 22.

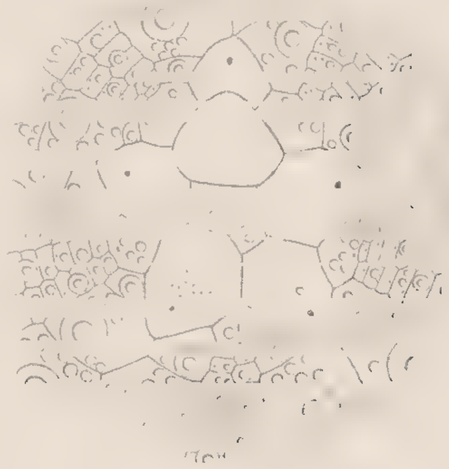
Plate 22.

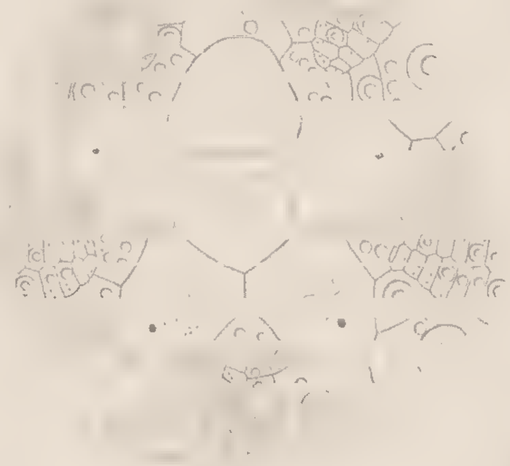
1–7. Acrosalenia spinosa Agass.

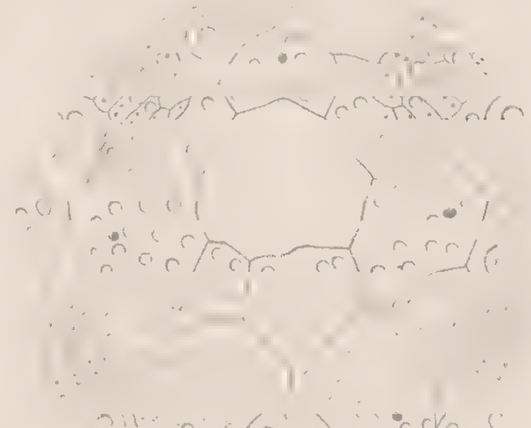
1. Part of actinostome of specimen measuring 8.8 mm. in diameter.
2. Part of actinostome of specimen measuring 9 mm. in diameter.
3. Actinal part of the right anterior ambulacrum of specimen measuring 13 mm. in diameter.
4. Abactinal system of specimen measuring 7.3 mm. in diameter.
5. Abactinal system of specimen measuring 9 mm. in diameter.
6. Abactinal system of specimen measuring 11.5 mm. in diameter.
7. Abactinal system of specimen measuring 13 mm. in diameter.

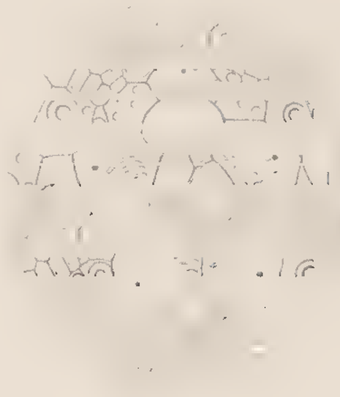
8. Acrosalenia Wiltonii Wright.

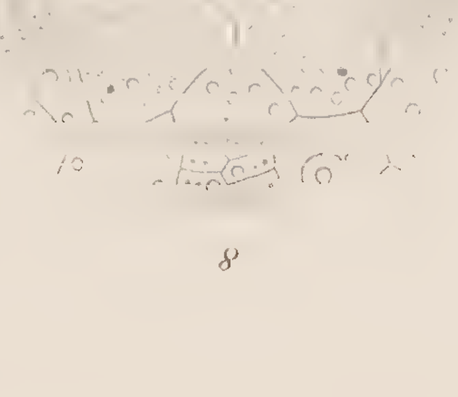
8. Abactinal system of specimen measuring 20 mm. in diameter.











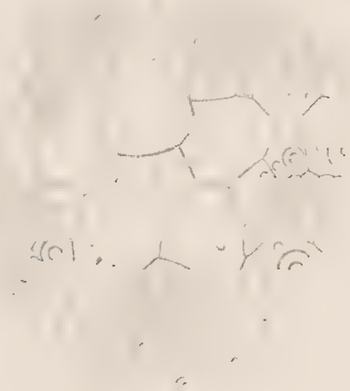


PLATE 23.

Plate 23.

1–13. **Dialithocidaris gemmifera** A. Ag.; Station 3382.

1. Actinal system of specimen measuring 21 mm. in diameter.
2. Abactinal system of same as fig. 1.
3. The same specimen as fig. 1, seen facing the left anterior interambulacrum.
4. Actinal part of odd anterior ambulacrum of same.
5. Actinal part of odd anterior ambulacrum, showing the auricles, seen from the exterior.
6. Actinal part of the left posterior interambulacrum and ambulacrum, seen from the interior.
7. One of the pores at the actinostome.
8. The tenth pore from the actinostome.
9. Ambulacral pore close to the ocular plate.
10. Eye-plate of the left posterior ambulacrum, seen from the interior.
11. Embryonic tubercles of the left anterior interambulacrum.
12. Primary tubercle, third plate from the actinostome, of the left posterior interambulacrum.
13. Base of primary radiole.

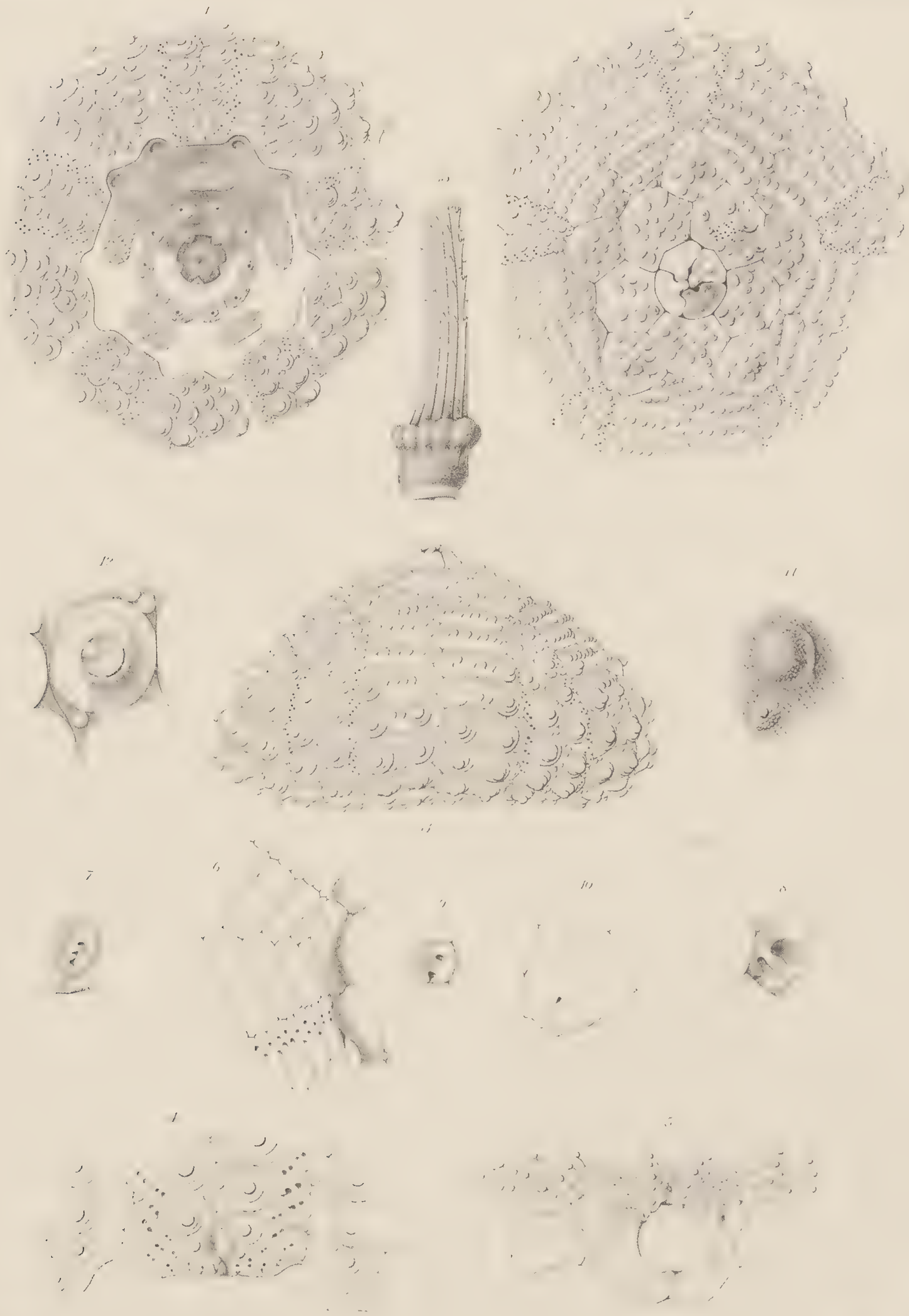


PLATE 24.

Plate 24.

1–3. **Dermatodiadema globulosum** A. Ag.

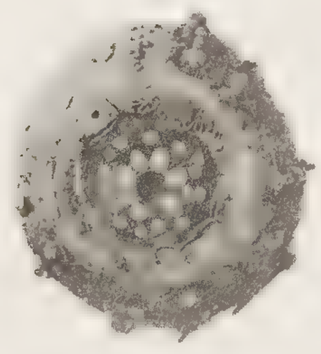
1. Seen from the abactinal side; Station 3381.
2. Somewhat smaller specimen from the abactinal side; Station 3398.
3. The same specimen as fig. 2, seen facing the right anterior ambulacrum.

4–12. **Dermatodiadema horridum** A. Ag.

4. Specimen with spines, seen from the abactinal side; Station 3413.
5. The same as fig. 4, seen facing the odd anterior ambulacrum.
6. Another specimen, partly denuded, seen from the actinal side; Station 3398.
7. A somewhat smaller specimen than fig. 6, seen from the actinal side; Station 3413.
8. The same as fig. 7, seen facing the right posterior ambulacrum.
9. The same as fig. 7, seen from the abactinal side.
10. A much smaller specimen, seen from the actinal side; Station 3407.
11. The same as fig. 10, seen from the abactinal side.
12. A small specimen, partly denuded, seen from the abactinal side; Station 3400.

All figures natural size.

1



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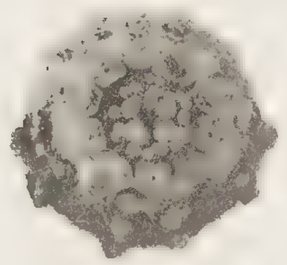

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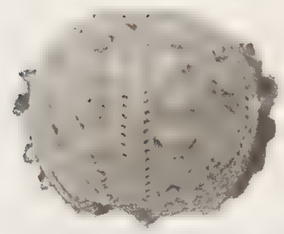

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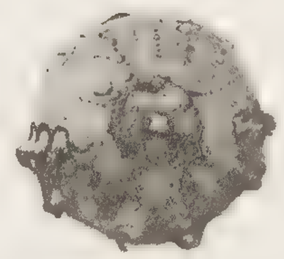

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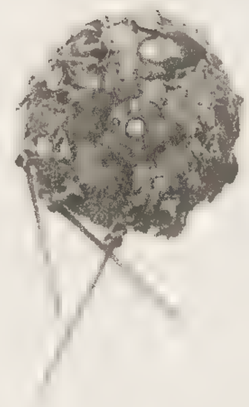

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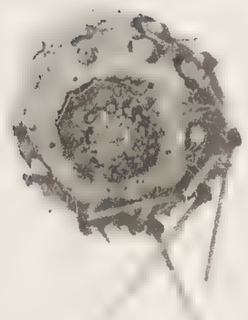

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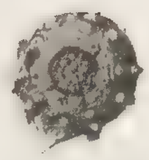

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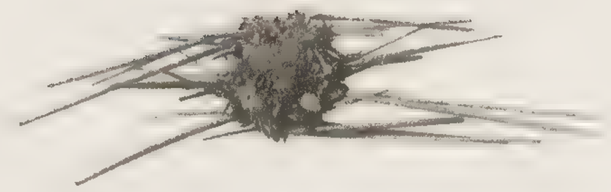


Heliotype Co., Boston

PLATE 25.

Plate 25.

1–6. Dermatodiadema horridum A. Ag.

1. Small specimen, measuring 7.3 mm. in diameter, seen from the actinal side; Station 3362.

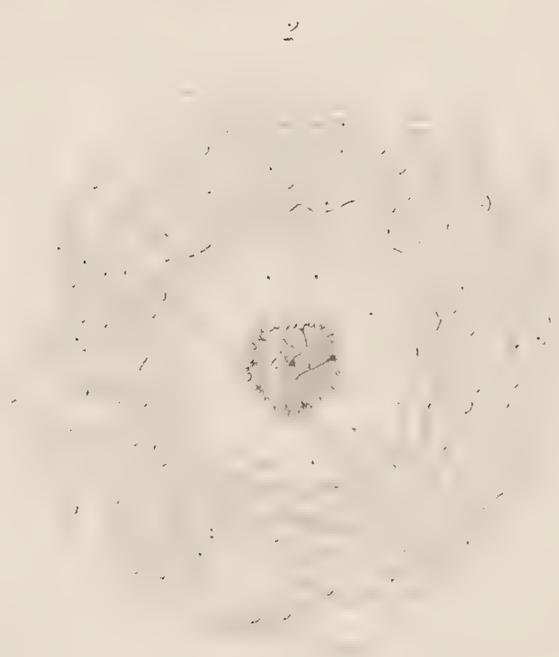
2. Actinal system of a specimen measuring 10 mm. in diameter; Station 3362.

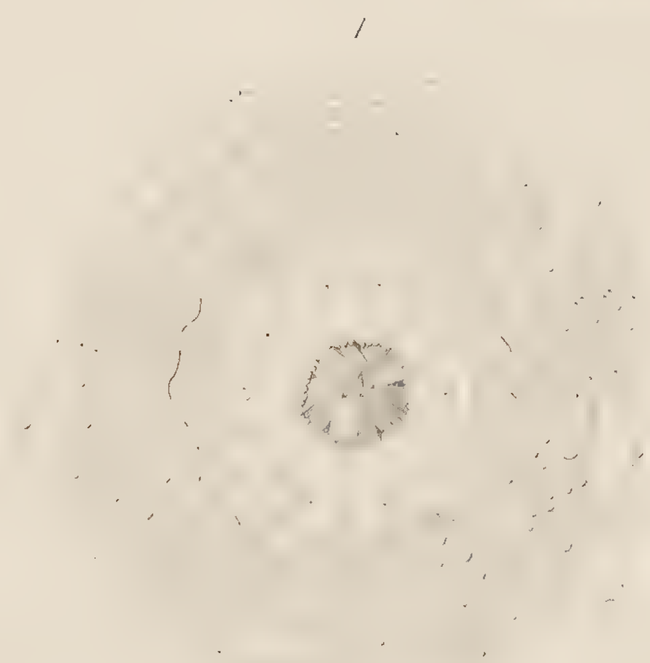
3. Enlarged view of actinal part of the odd anterior ambulacrum of the same specimen as fig. 2.

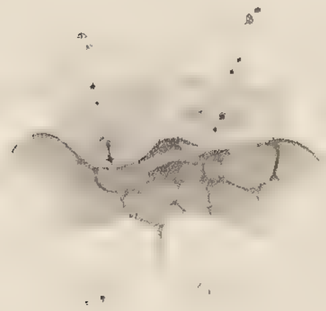
4. Actinal system of a specimen measuring 10.5 mm. in diameter; Station 3363.

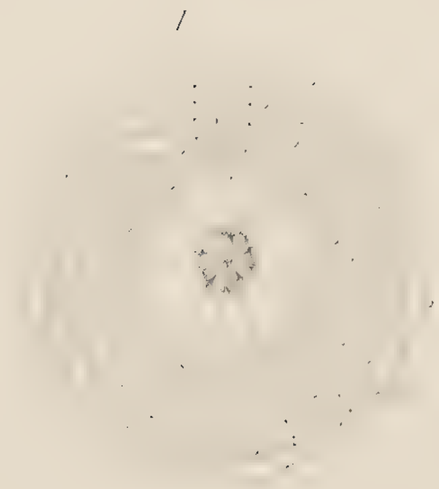
5. Actinal system of a specimen measuring 15 mm. in diameter; Station 3413.

6. Lower part of primary interambulacral spine of a specimen measuring 20 mm. in diameter; Station 3413.









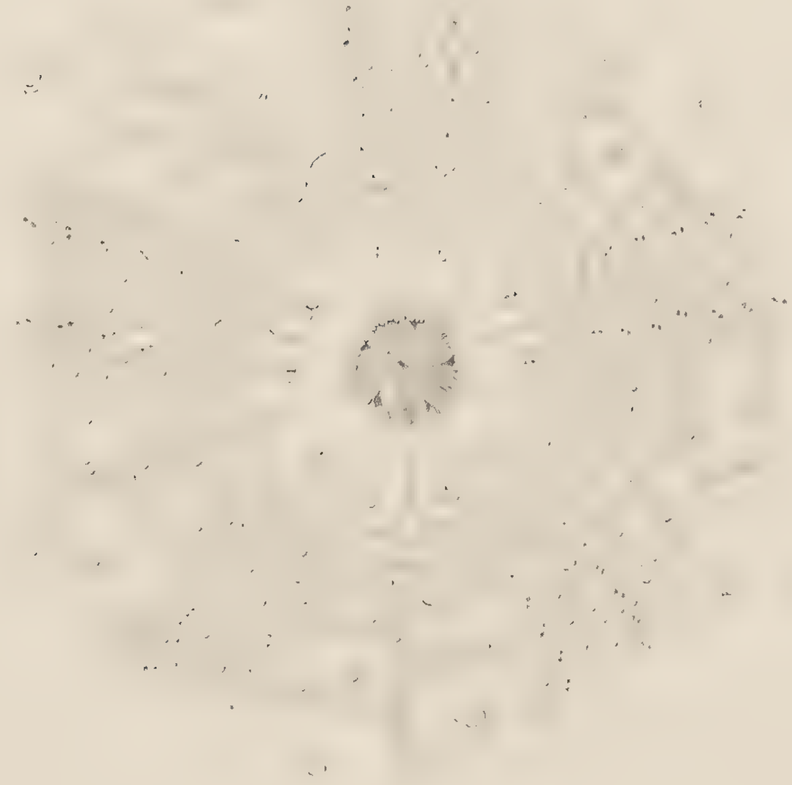


PLATE 26.

Plate 26.

1, 3, 4. Dermatodiadema horridum A. Ag.

1. Actinal system of specimen measuring 20 mm. in diameter; Station 3413.

3. Left posterior ambulacrum of specimen measuring 9 mm. in diameter with 6–7 primary tubercles; Station 3364.

4. Odd anterior ambulacrum of a specimen measuring 19 mm. in diameter with 7–8 primary plates; Station 3413.

2. Dermatodiadema globulosum A. Ag.

2. Part of actinal system of specimen measuring about 30 mm. in diameter; the right anterior ambulacrum extends upwards; Station 3381.

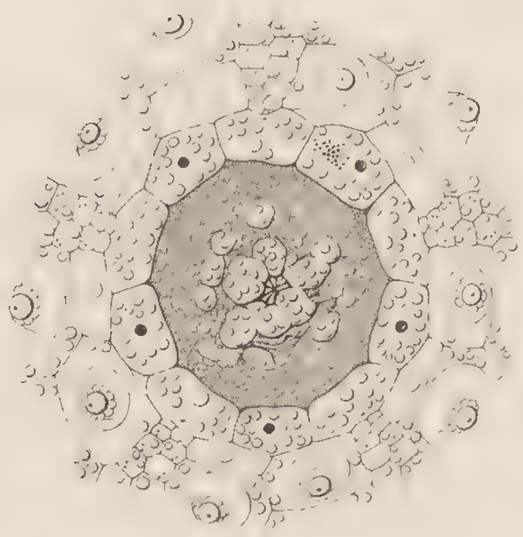
PLATE 27.

Plate 27.

1–6. Dermatodiadema horridum A. Ag.

1. Plates of part of abactinal system of small specimen measuring 6 mm. in diameter; Station 3364.
2. Abactinal system of specimen measuring 6.8 mm. in diameter; Station 3363.
3. Abactinal system of specimen measuring 10 mm. in diameter; Station 3362.
4. Abactinal system of specimen measuring 12 mm. in diameter; Station 3400.
5. Abactinal system of specimen measuring 14 mm. in diameter; Station 3398.
6. Abactinal system of specimen measuring 14 mm. in diameter; Station 3413.

4



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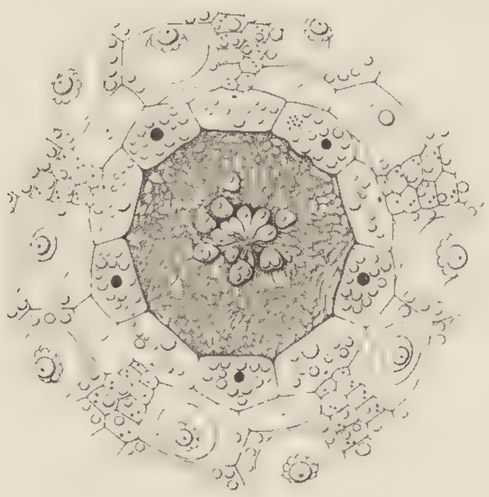

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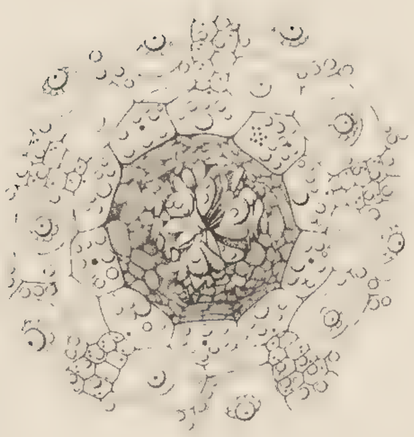

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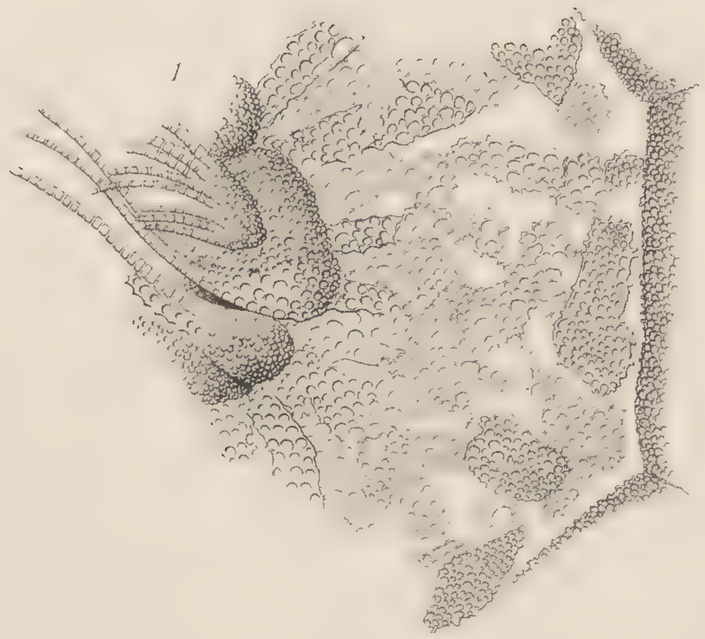

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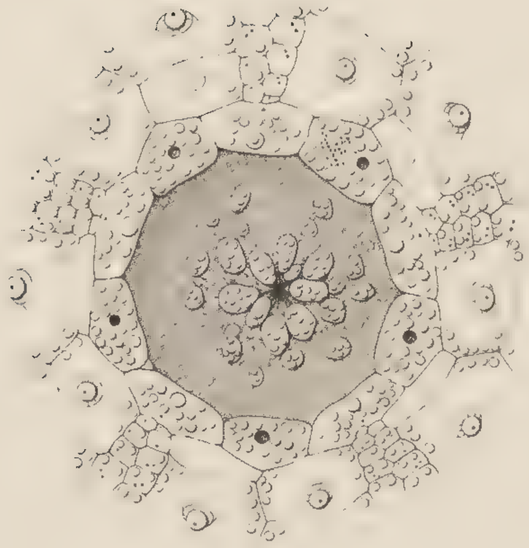

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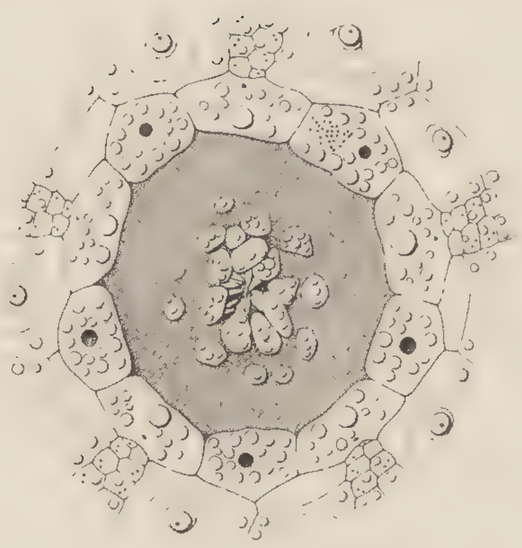


C. C. Wiederhold lith.

L. Meyer fec.

PLATE 28.

Plate 28.

1, 2. **Dermatodiadema horridum** A. Ag.

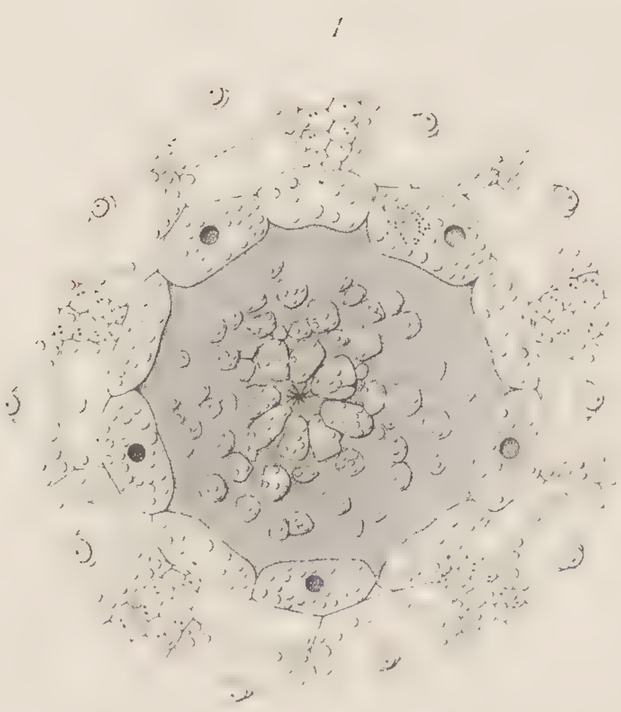
1. Abactinal system of a specimen measuring 20 mm. in diameter with 7–8 primary tubercles; Station 3413.

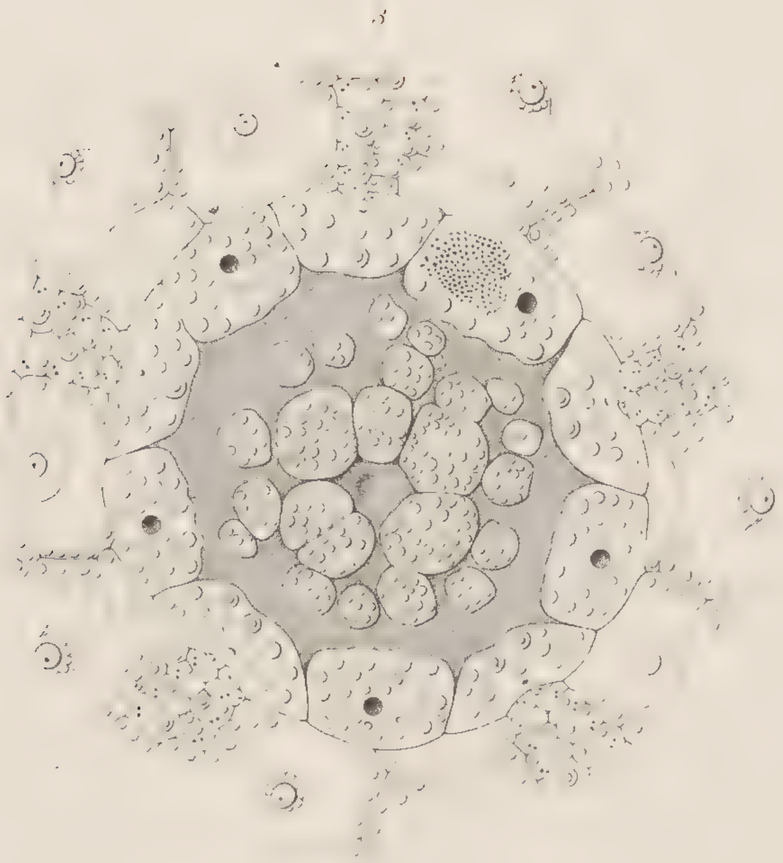
2. Abactinal system of another specimen of the same size as fig. 1, with smaller and more crowded anal plates; Station 3413.

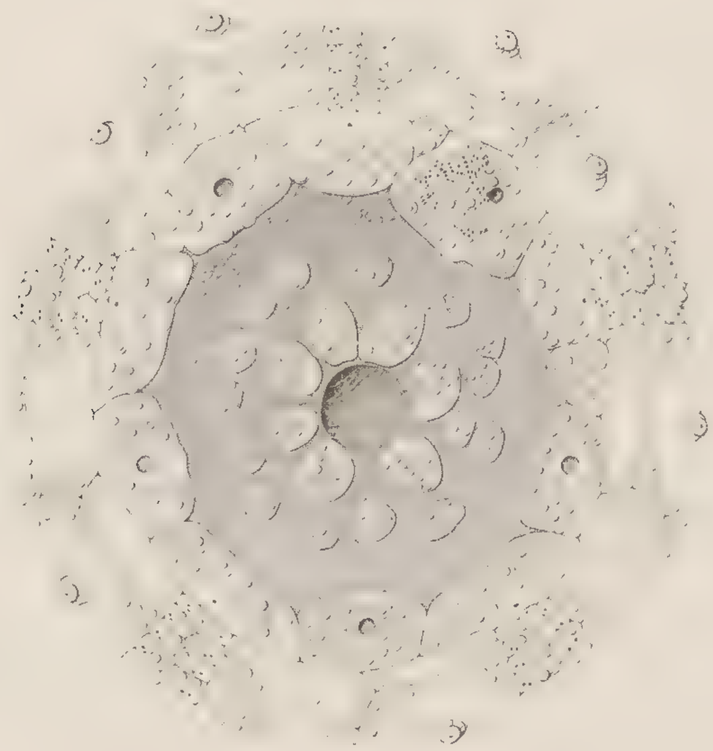
3, 4. **Dermatodiadema globulosum** A. Ag.

3. Abactinal system of a specimen measuring 25 mm. in diameter; Station 3398.

4. Abactinal system of a specimen measuring 30 mm. in diameter; Station 3381.







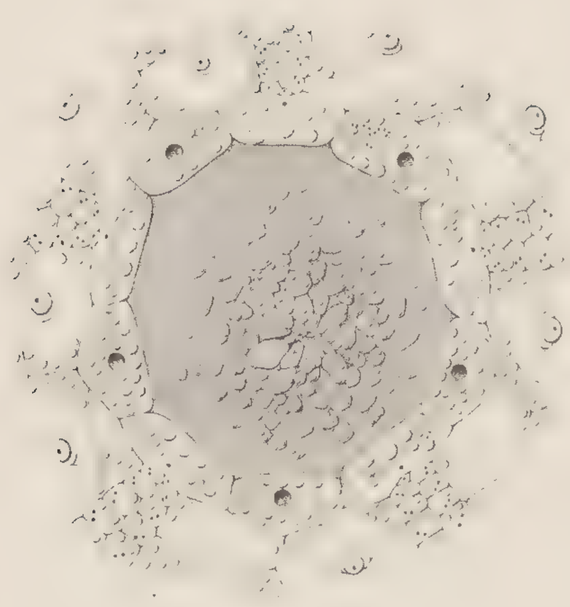


PLATE 29.

Plate 29.

1–4. Dermatodiadema horridum A. Ag.

1. The odd anterior ambulacrum of a specimen measuring 10.5 mm. in diameter with 6–7 primary tubercles; Station 3363.

2. The left anterior interambulacrum of the same specimen as fig. 1 (Actinal syst. Pl. 25, fig. 4).

3. The odd anterior ambulacrum of a specimen measuring 20 mm. in diameter with 7–8 primary tubercles; Station 3413.

4. The left anterior interambulacrum of the same specimen as fig. 3 (Abactinal syst. Pl. 28, fig. 1; actinal syst. Pl. 26, fig. 1).

5–7. Dermatodiadema globulosum A. Ag.

5. The left posterior ambulacrum of a specimen measuring 25 mm. in diameter with 8–9 primary tubercles; Station 3398.

6. The left posterior interambulacrum of the same specimen as fig. 5 (Abactinal syst. Pl. 28, fig. 3).

7. The abactinal part of the right anterior ambulacrum of a specimen measuring 30 mm. (Abactinal syst. Pl. 28, fig. 4; actinal syst. Pl. 26, fig. 2); Station 3381.

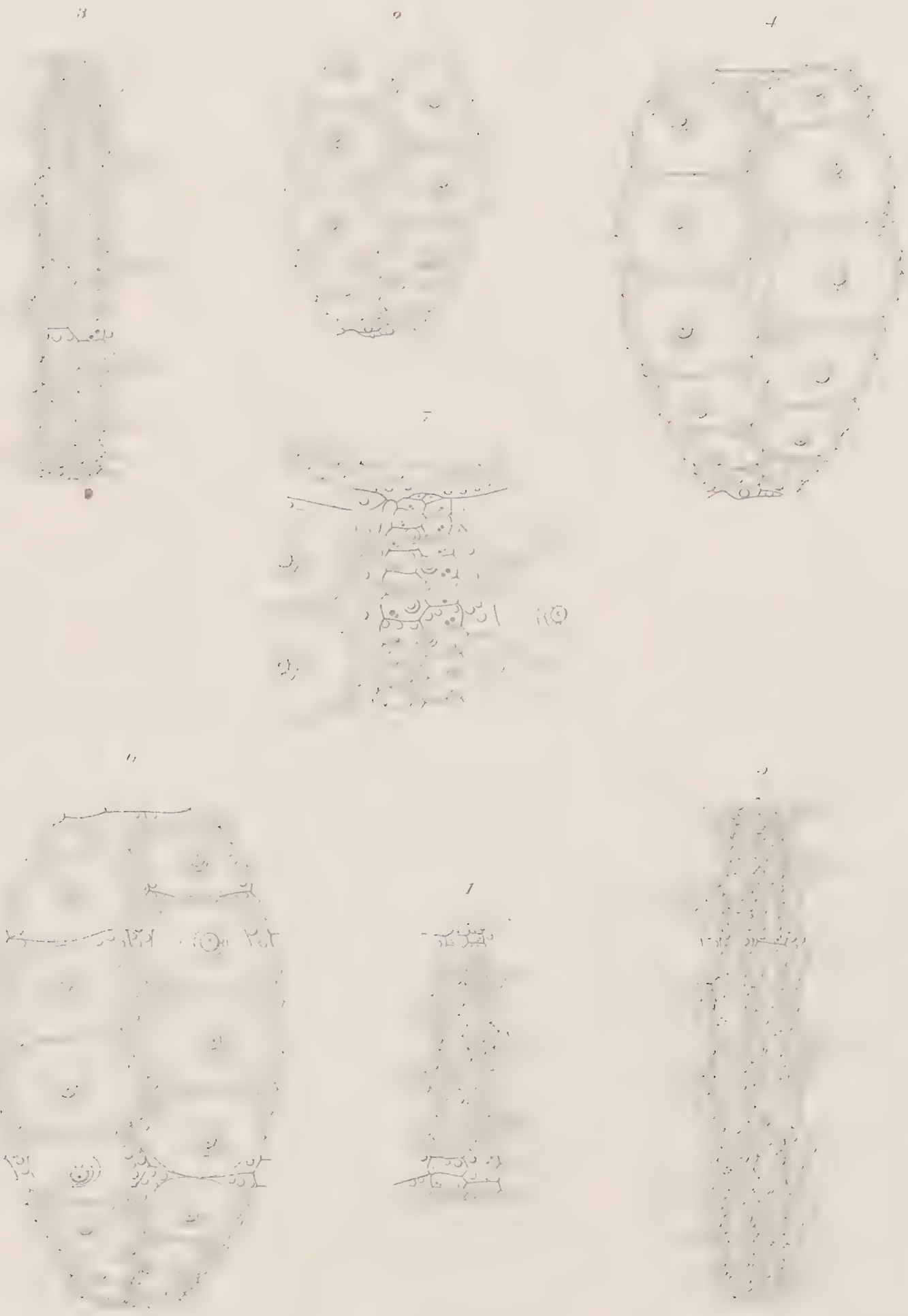


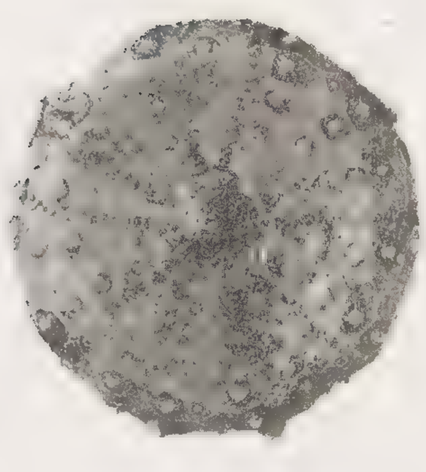
PLATE 30.

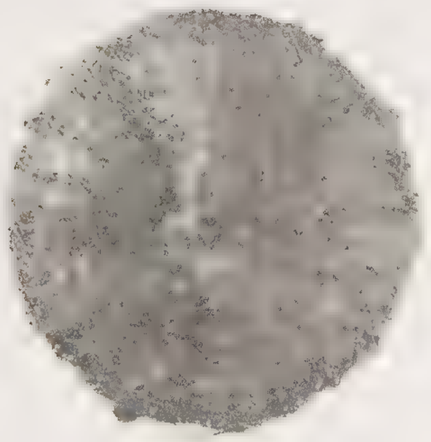
Plate 30.

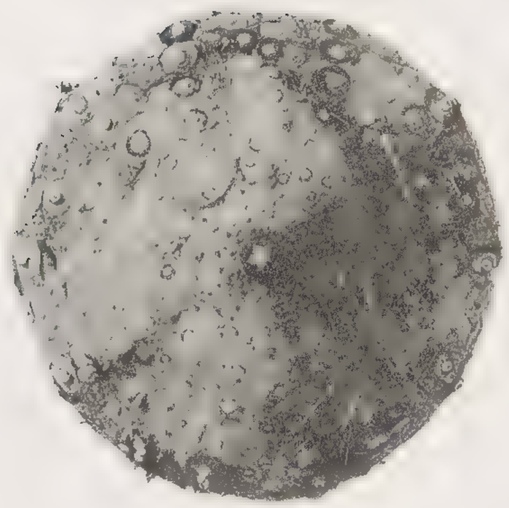
1–10. **Phormosoma hispidum** A. Ag.

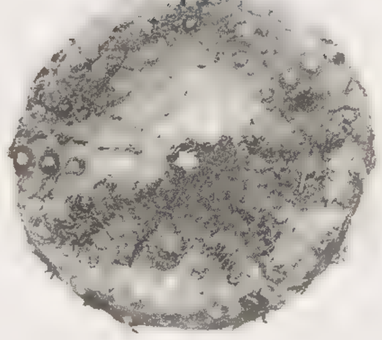
1. Actinal view of a specimen from Station 3362.
2. Abactinal view of same as fig. 1, measuring 15 mm. in diameter.
3. Actinal view of larger specimen from Station 3362, measuring 34 mm.
4. Abactinal view of the same specimen as fig. 3.
5. Actinal view of specimen measuring 38 mm. in diameter; Station 3374.
6. Abactinal view of same specimen as fig. 5.
7. Actinal view of specimen measuring 45 mm.; Station 3376.
8. Abactinal view of the same as fig. 7.
9. Actinal view of specimen measuring 53 mm. in diameter; Station 3376.
10. Same specimen as fig. 9, seen from the abactinal side.

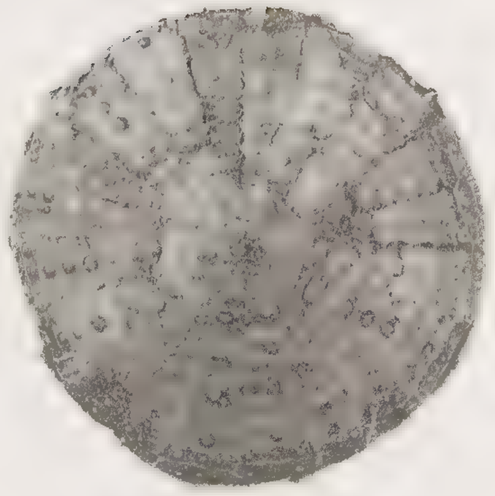
All figures natural size.

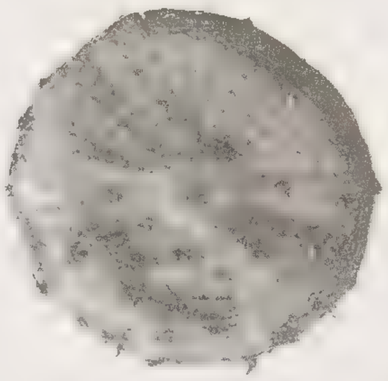


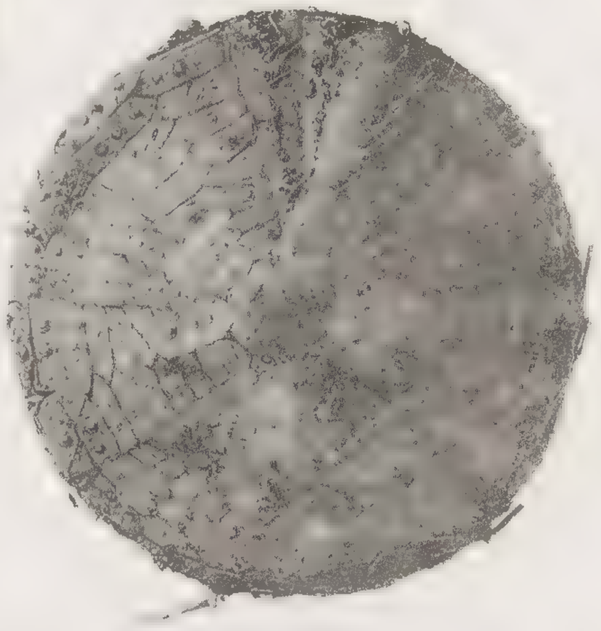


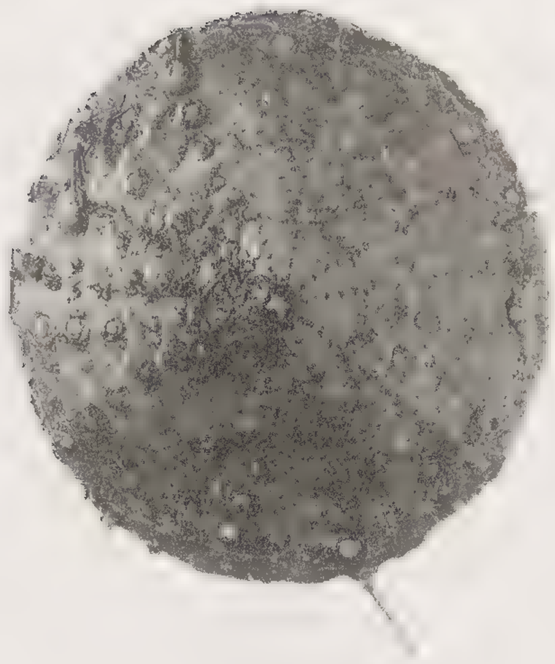












Helioty[illegible]Boston

PLATE 31.

Plate 31.

1–3. Phormosoma hispidum A. Ag.

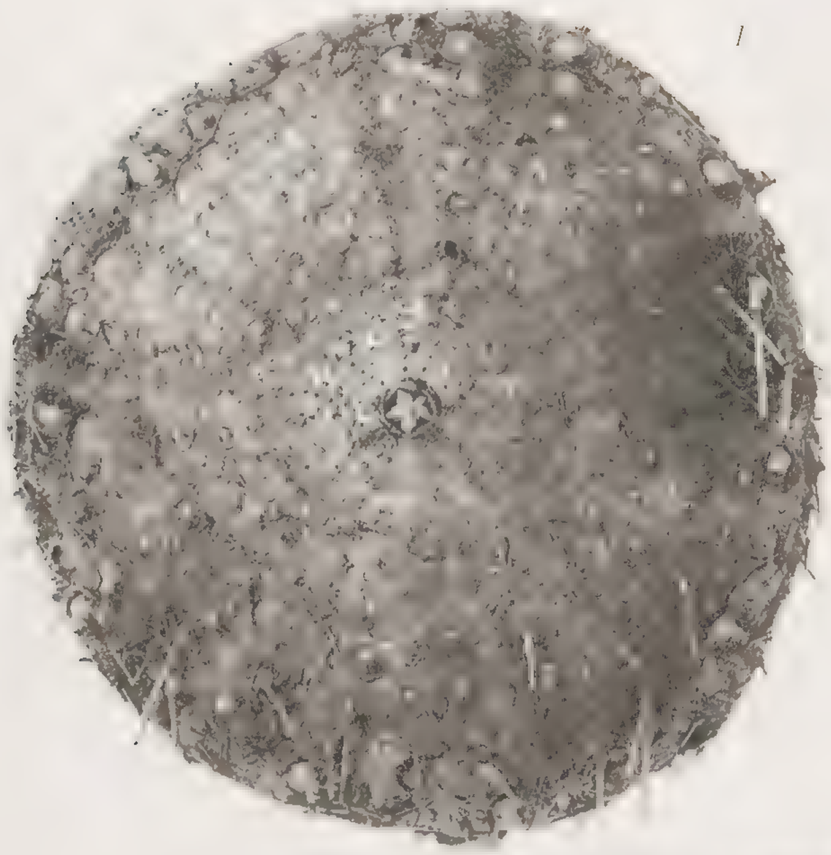
1. Partly denuded test of a specimen measuring 75 mm., seen from the actinal side; Station 3392.

2. Same as fig. 1, seen from the abactinal side.

3. Actinal view of the denuded test of a specimen measuring 120 mm. in diameter; Station 3376.

All figures natural size.

1



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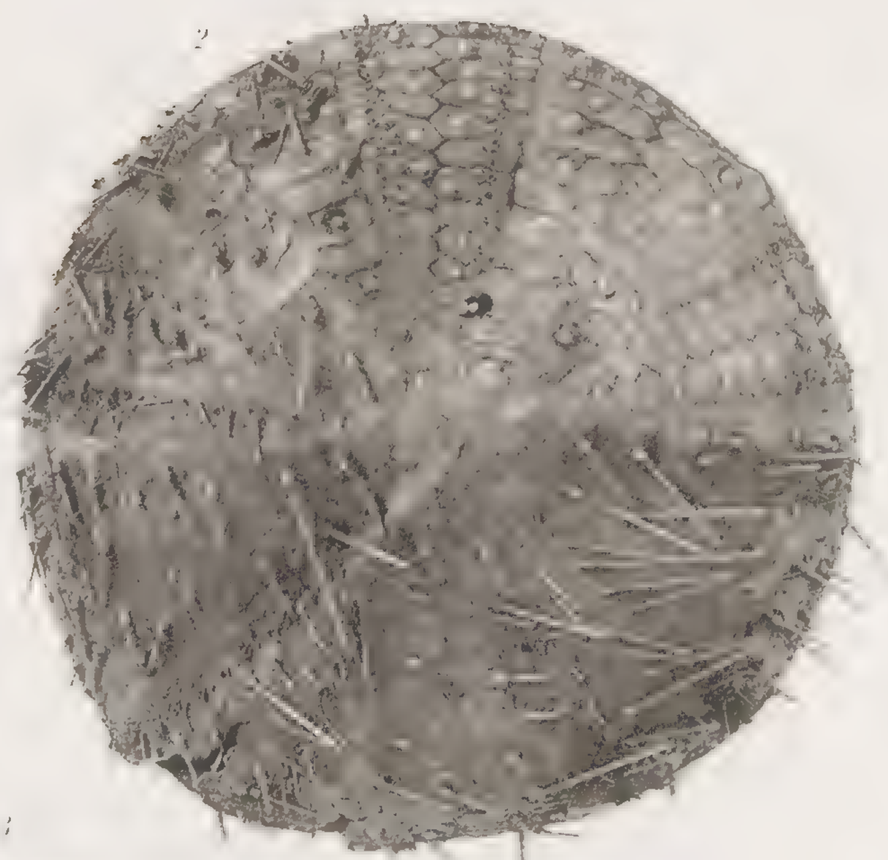


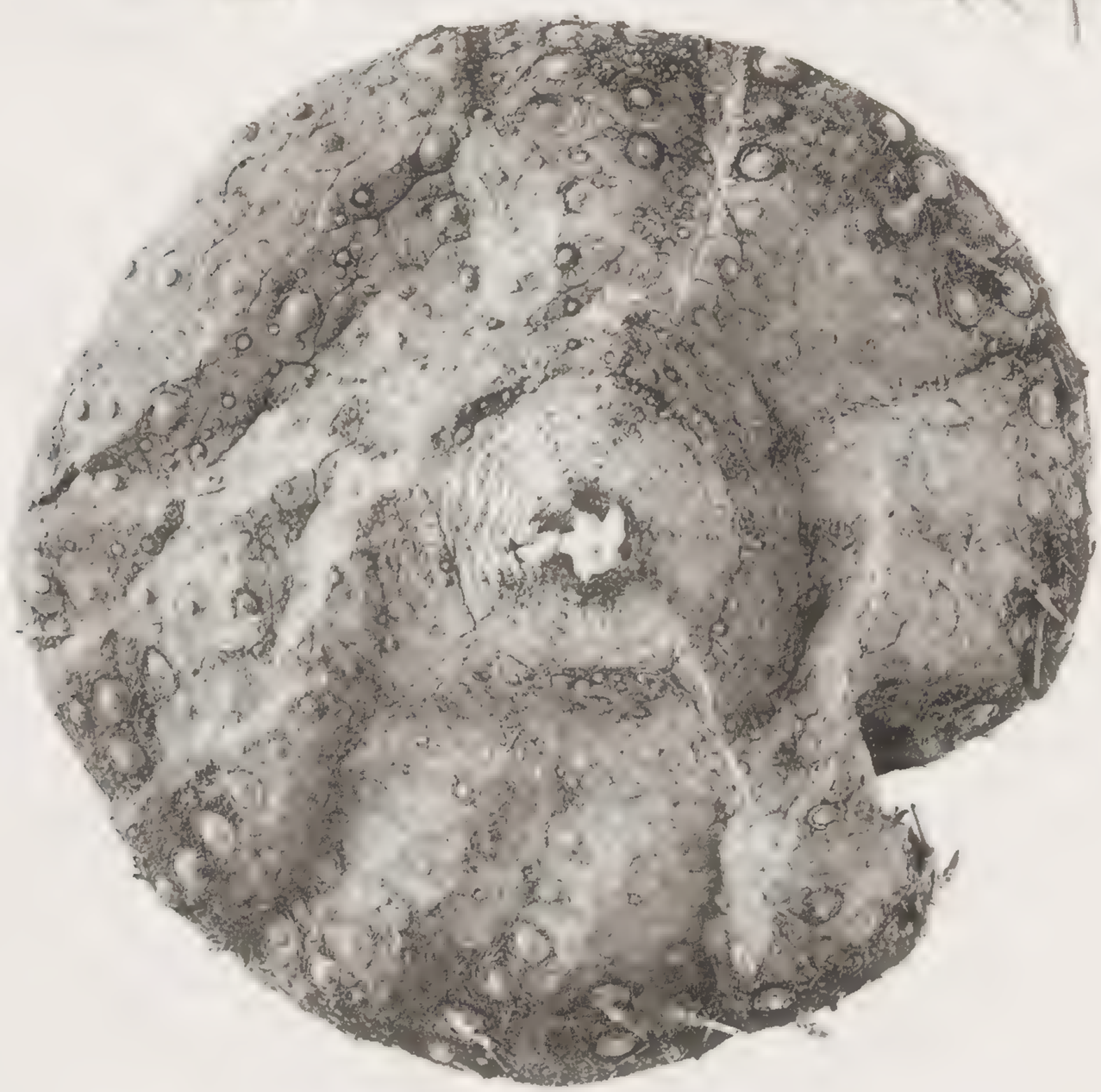


PLATE 32.

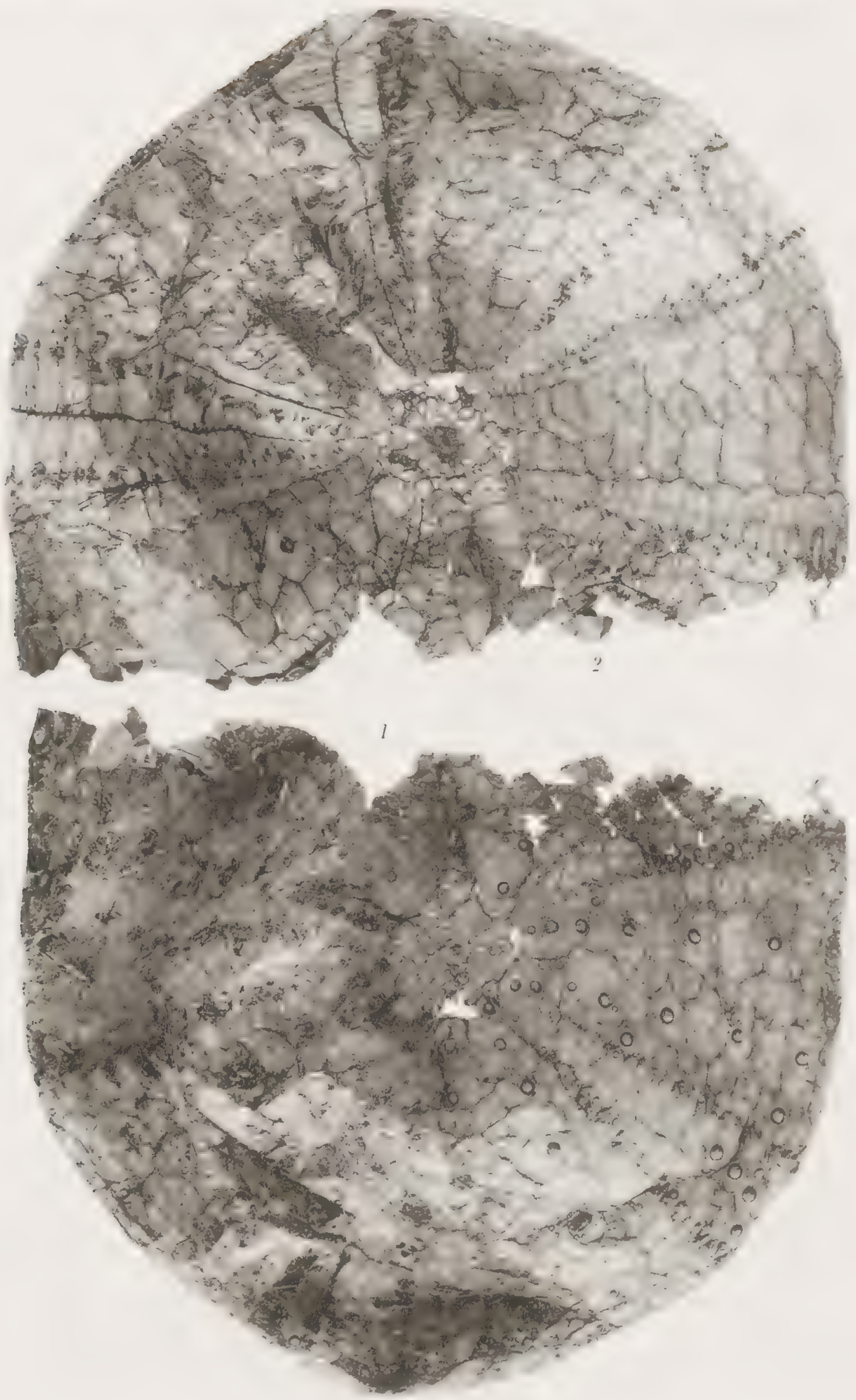
Plate 32.

1, 2. Phormosoma hispidum A. Ag.

1. Abactinal view of the partly denuded test of an imperfect specimen measuring 123 mm. in diameter; Station 3400.

2. The same specimen as fig. 1, seen from the interior.

The odd ambulacrum of both figures points to the left; figures natural size.



2

1

PLATE 33.

Plate 33.

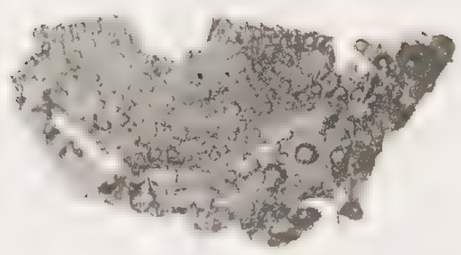
1–3. Phormosoma hispidum A. Ag.

1. Denuded plates of the actinal system (fragment) in prolongation of the odd interambulacrum of a specimen from Station 3398.

2. The same, seen from the interior.

3. View of the interior of an imperfect specimen measuring 120 mm. in diameter, showing the lanterns and auricles and a number of the ambulacral branches; all figures natural size; Station 3400.

1



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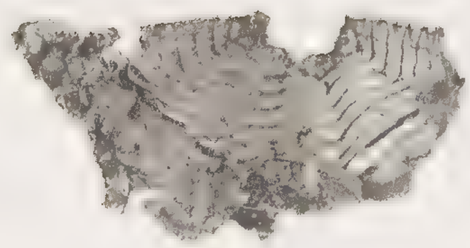


3

PLATE 34.

Plate 34.

1–3. Phormosoma hispidum A. Ag.

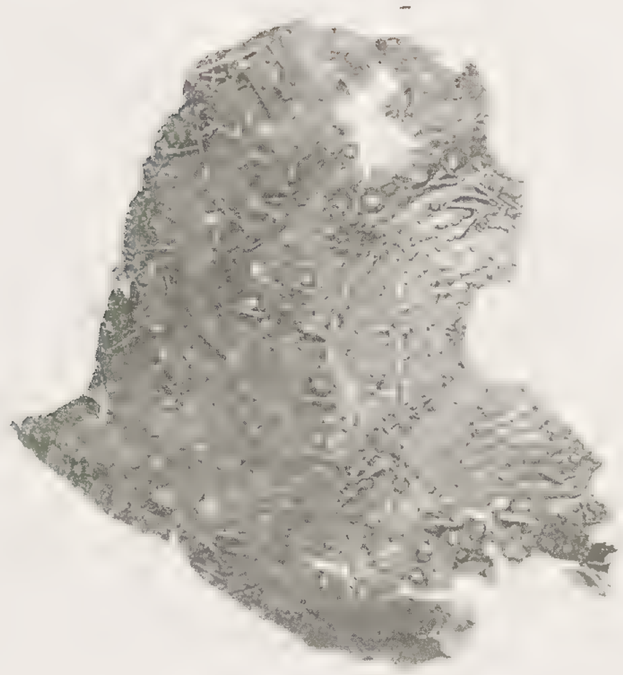
1. Interior view of an imperfect specimen showing the imbrication of the interambulacral areas and the reverse imbrication of the actinal system and ambulacral zones in a specimen measuring about 140 mm. in diameter; Station 3400.

2. A part of the actinostome, seen from the exterior, from fragments of a specimen of about the diameter of fig. 1; Station 3332.

3. The same fragment as fig. 2, seen from the interior.

All figures natural size.

2



3

1

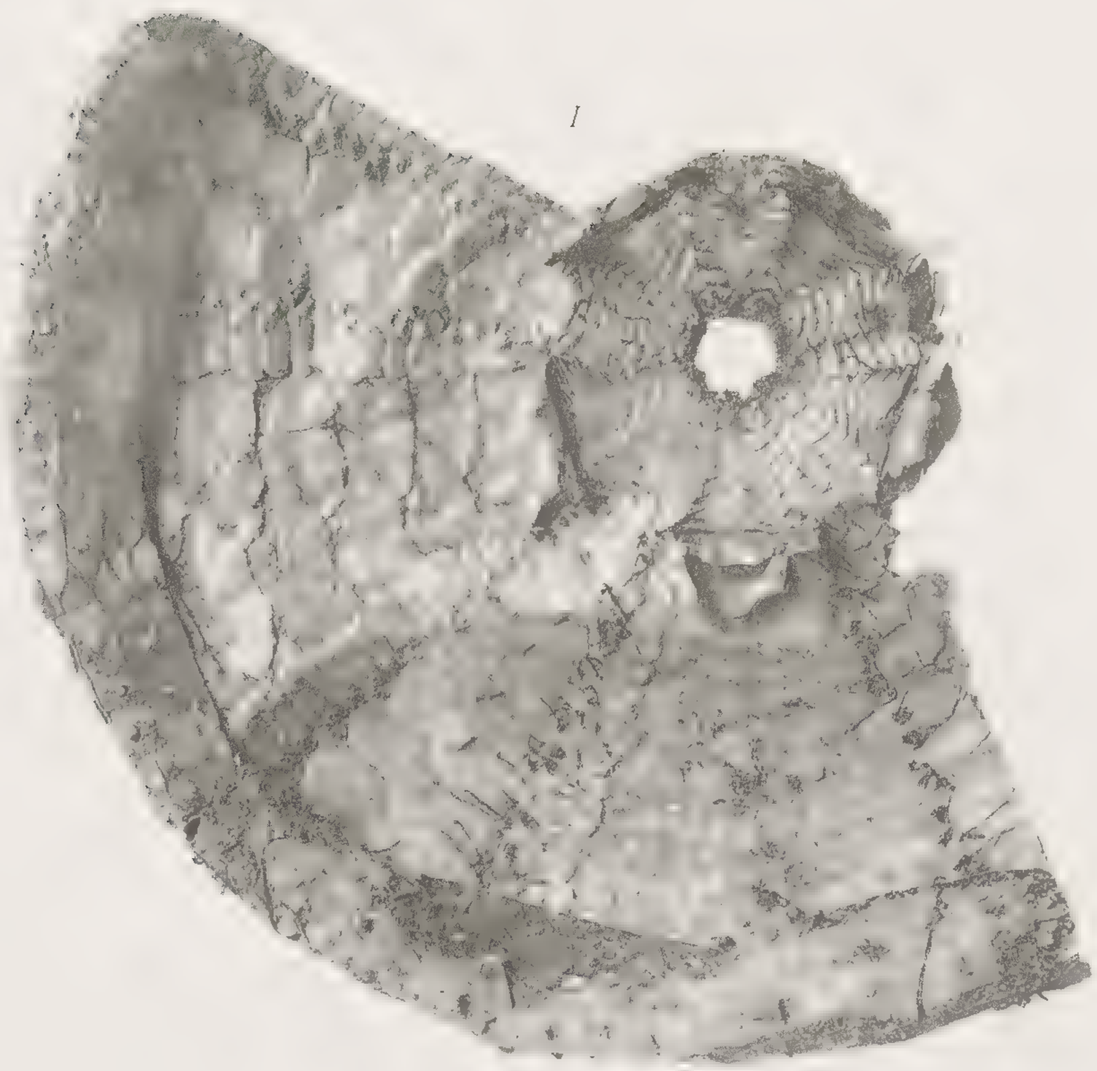


PLATE 35.

Plate 35.

Phormosoma hispidum A. Ag.

Seen from the actinal side, natural size, 135 mm. in diameter; Station 3393.

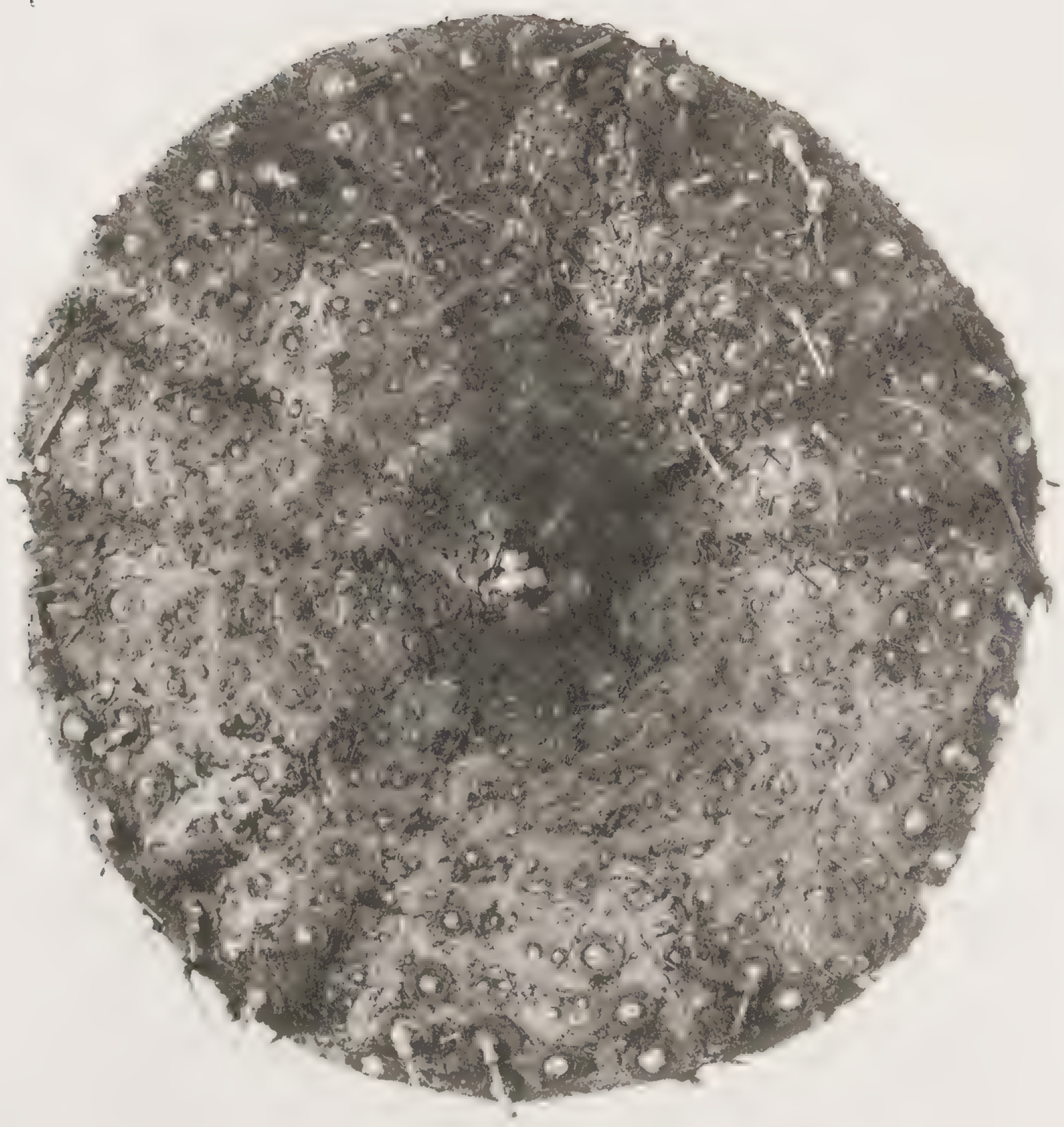


PLATE 36.

Plate 36.

Phormosoma hispidum A. Ag.

The same specimen as that figured in Plate 35, natural size, 135 mm. in diameter, seen from the abactinal side ; Station 3393.

Heliotype Co., Boston

PLATE 37.

Plate 37.

Phormosoma hispidum A. Ag.

A specimen seen from the actinal side, partly denuded, measuring 203 mm. in diameter, three quarters natural size; Station 3413.

PLATE 38.

Plate 38.

Phormosoma hispidum A. Ag.

The same as specimen figured on Pl. 37, seen from the abactinal side, measuring 203 mm. in diameter; Station 3413.

PLATE 39.

Plate 39.

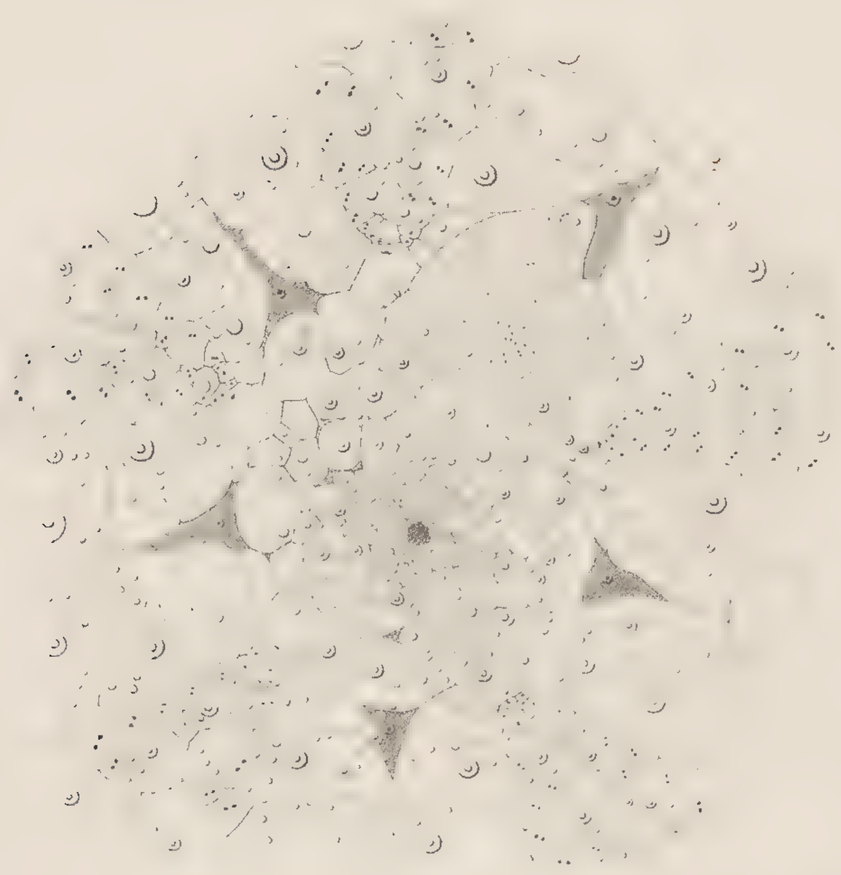
1–3. **Phormosoma hispidum** A. Ag.

1. Abactinal system of a specimen measuring 120 mm. in diameter; Station 3431.
2. Abactinal system of a specimen abt. 130 mm. in diameter; Station 3400.
3. Abactinal system of specimen 203 mm. in diameter (Pl. 38); Station 3413.

ALBATROSS EX 1891

EDIN. PLATE 20

1



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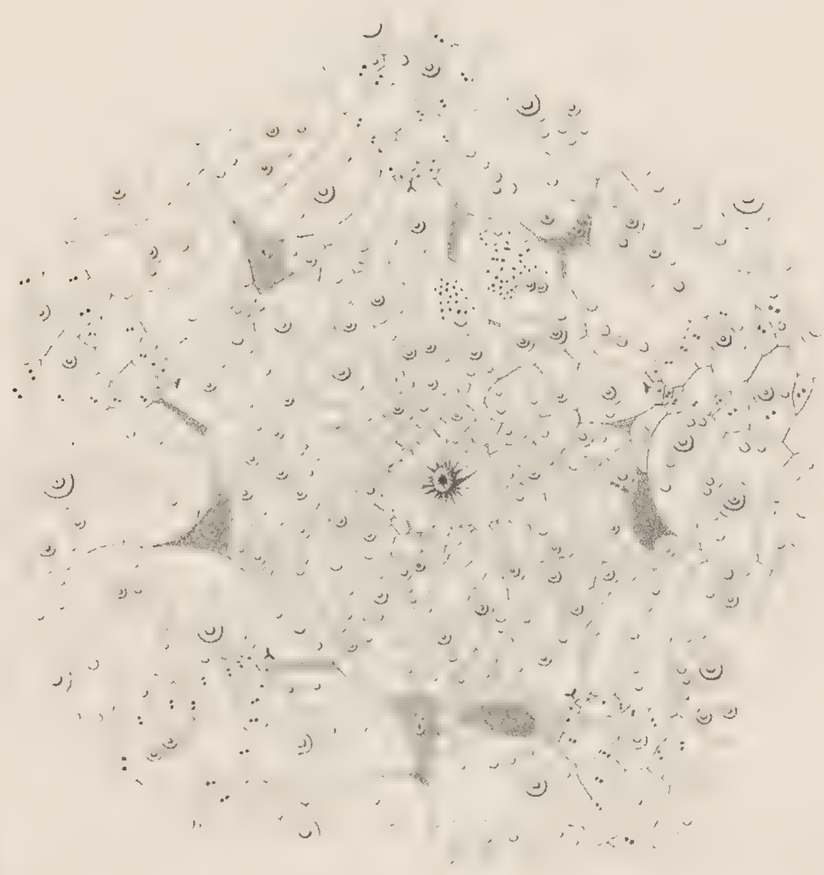


J. M. Westerëren del.

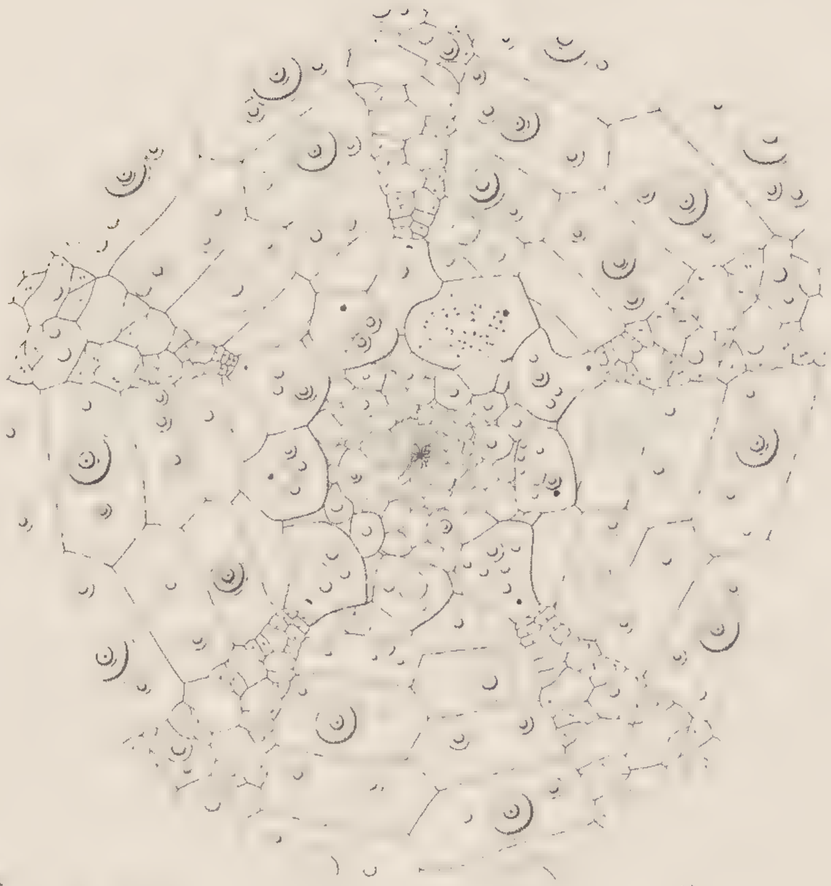
P. Wa... lith.

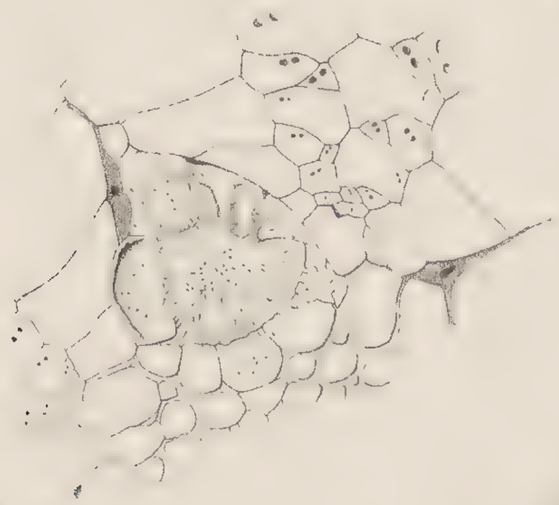
PLATE 40.

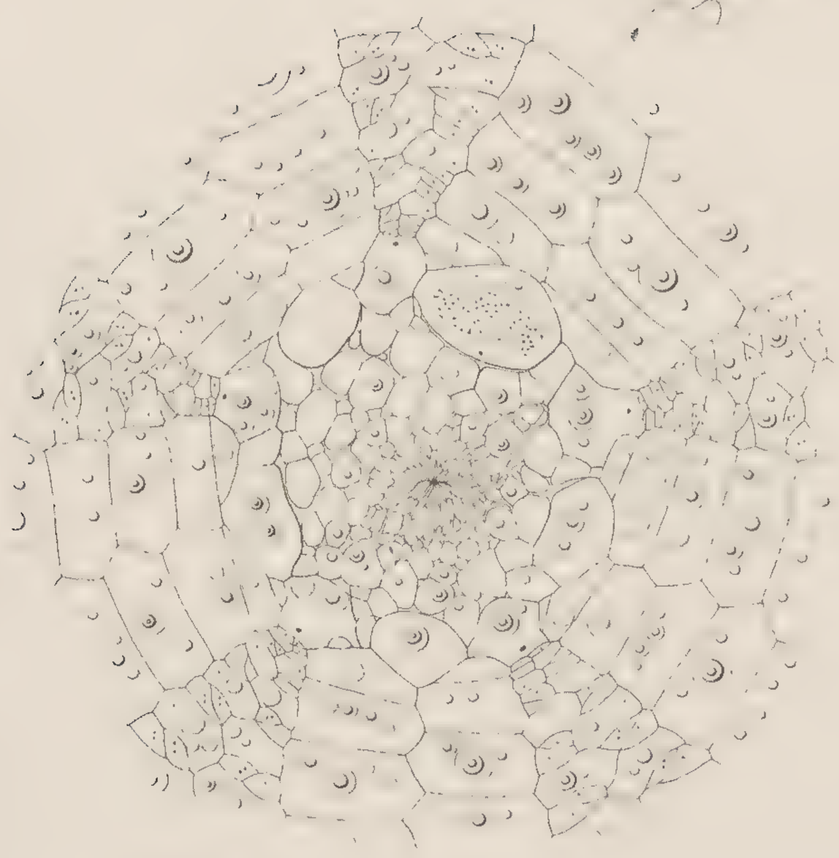
Plate 40.

1–5. Phormosoma hispidum A. Ag.

1. Abactinal system of a specimen measuring 15 mm. in diameter (Pl. 30, figs. 1, 2); Station 3362.
2. Abactinal system of a specimen 34 mm. in diameter (Pl. 30, figs. 2, 3); Station 3362.
3. Abactinal system of a specimen 53 mm. in diameter (Pl. 30, figs. 9, 10); Station 3376.
4. Abactinal system of a specimen 75 mm. in diameter (Pl. 31, figs. 1, 2); Station 3392.
5. Specimen 120 mm. in diameter, in which the madreporite is in the left anterior ambulacrum; Station 3431.







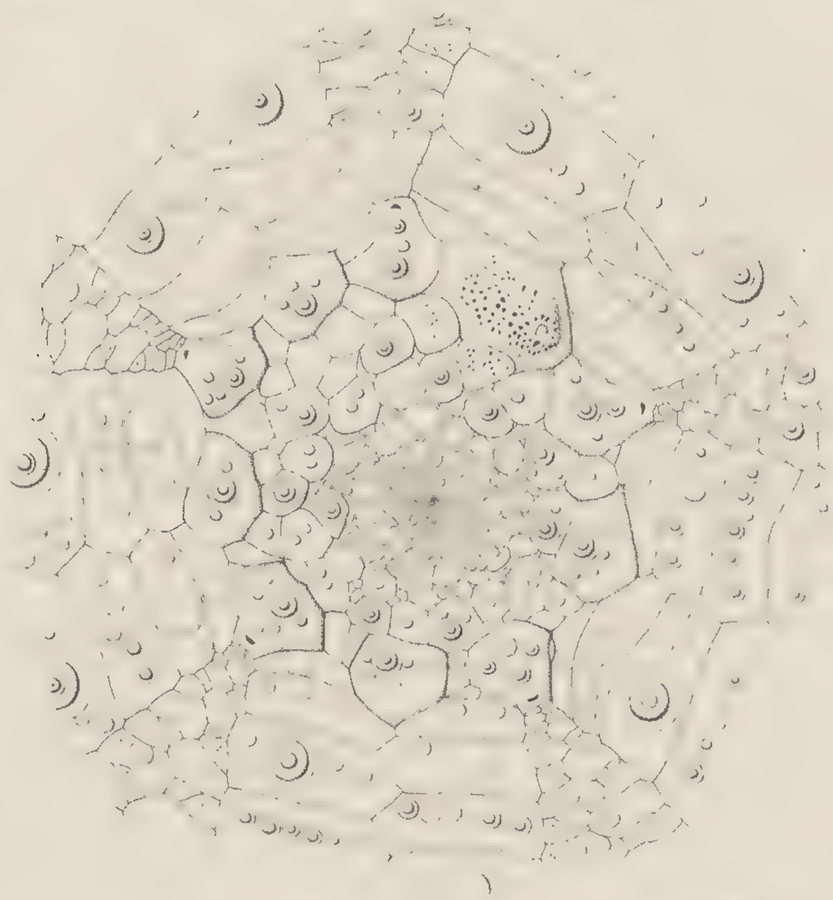


PLATE 41.

Plate 41.

1, 2. Phormosoma hispidum A. Ag.

1. Actinal system of specimen 120 mm. in diameter; Station 3431.

2. Actinal system of specimen 203 mm. in diameter (Pl. 37); Station 3413.

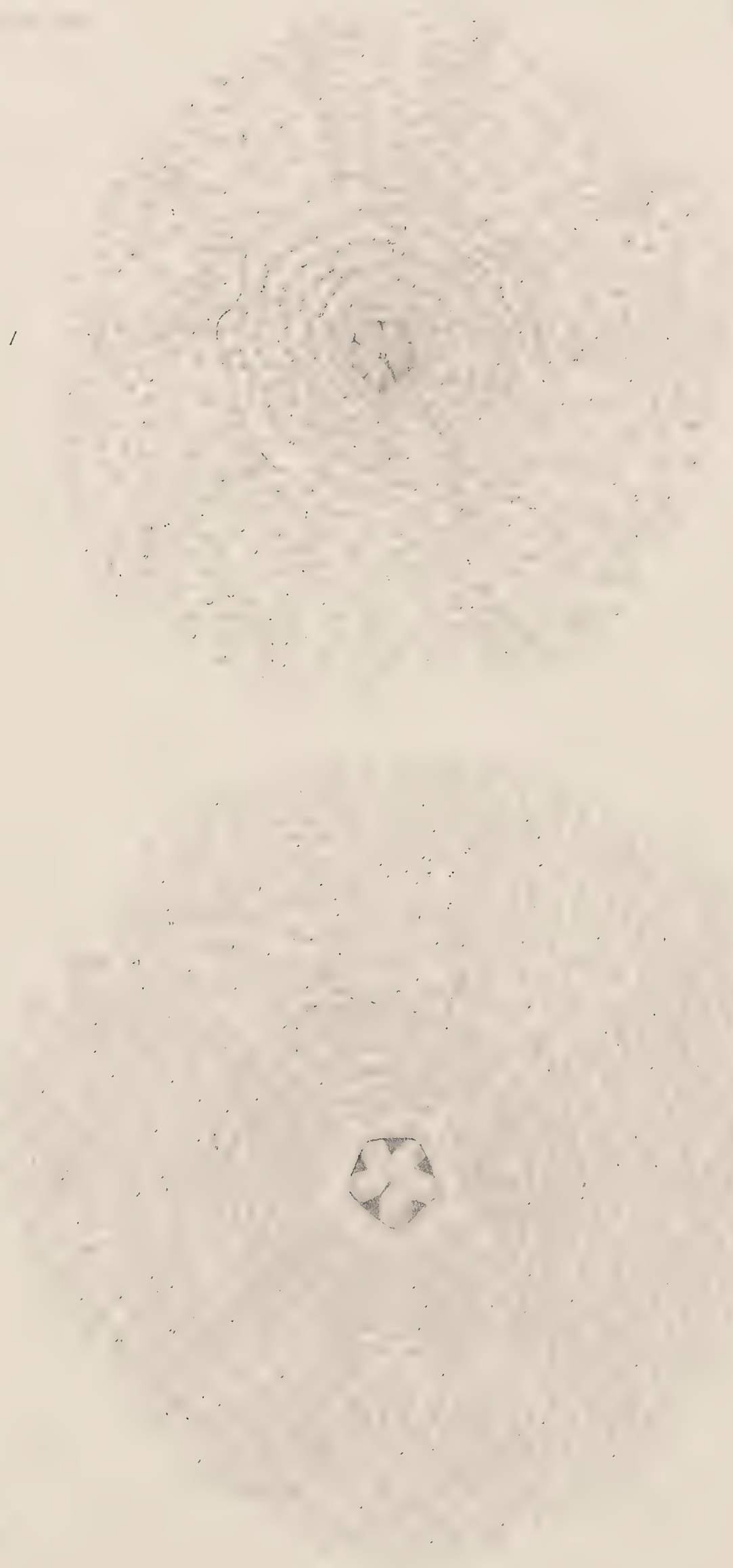


PLATE 42.

Plate 42.

1, 2. Phormosoma hispidum A. Ag.

1. Actinal system of specimen 53 mm. in diameter; Station 3376.

2. Actinal system of specimen 75 mm. in diameter (Pl. 31, figs. 1, 2); Station 3392.

PLATE 43.

Plate 43.

1–4. Phormosoma placenta.

1. Actinal system of specimen 7 mm. in diameter; "Blake" Station 150, off Nevis 375 fms.

2. Abactinal system of same specimen as fig. 1.

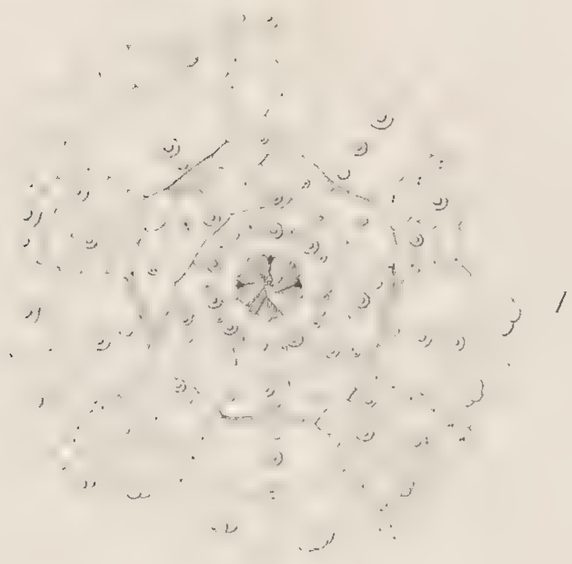
3. Actinal system of specimen 9 mm. in diameter; "Blake" Station 29, off Tortugas 955 fms.

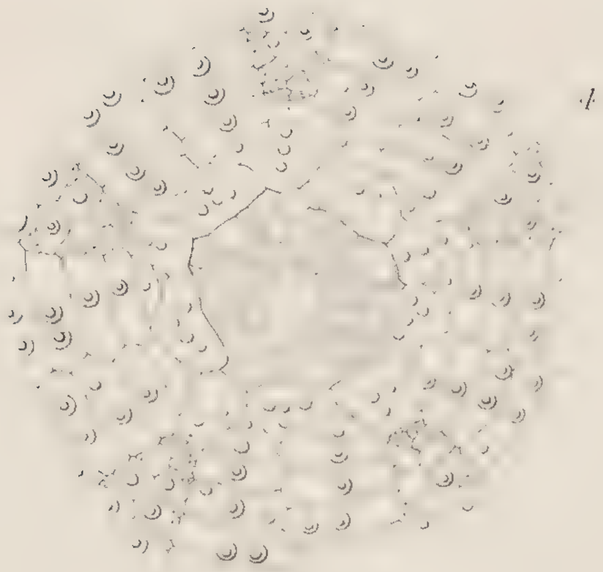
4 Abactinal system of same specimen as fig. 3.

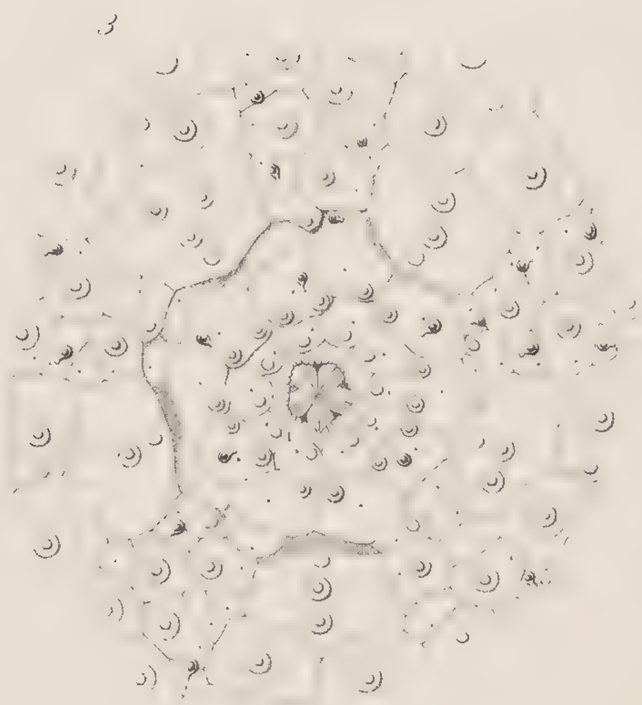
5, 6. Phormosoma hispidum A. Ag.

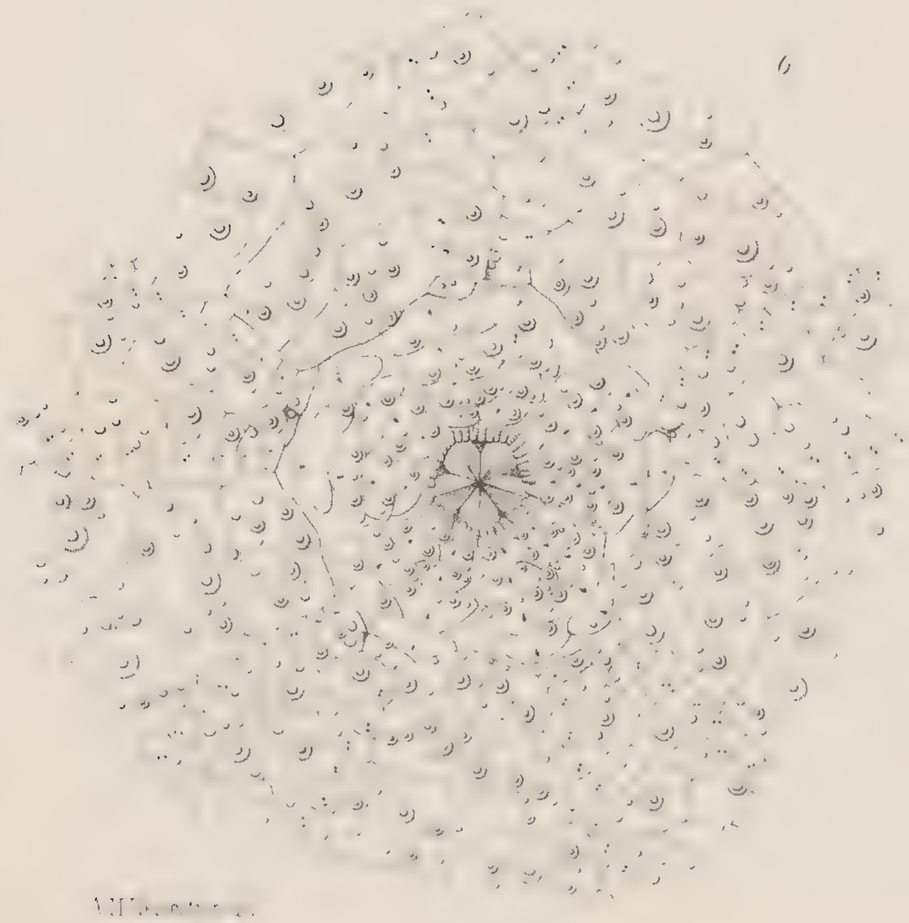
5. Actinal system of specimen 15 mm. in diameter (Pl. 30, figs. 1, 2); Station 3362.

6. Actinal system of specimen 34 mm. in diameter (Pl. 30, figs. 3, 4); Station 3362.









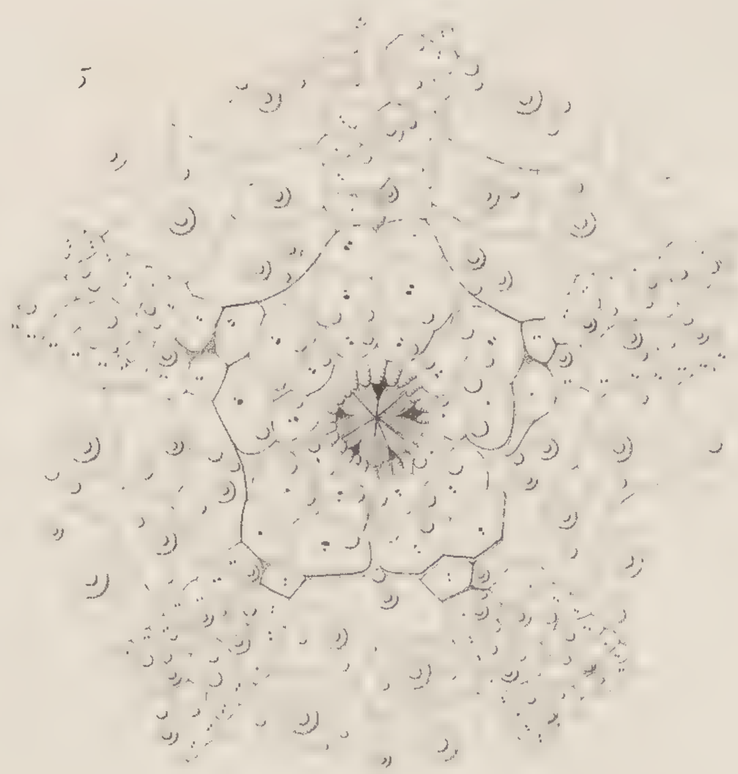


PLATE 44.

Plate 44.

1–5. Phormosoma hispidum A. Ag.

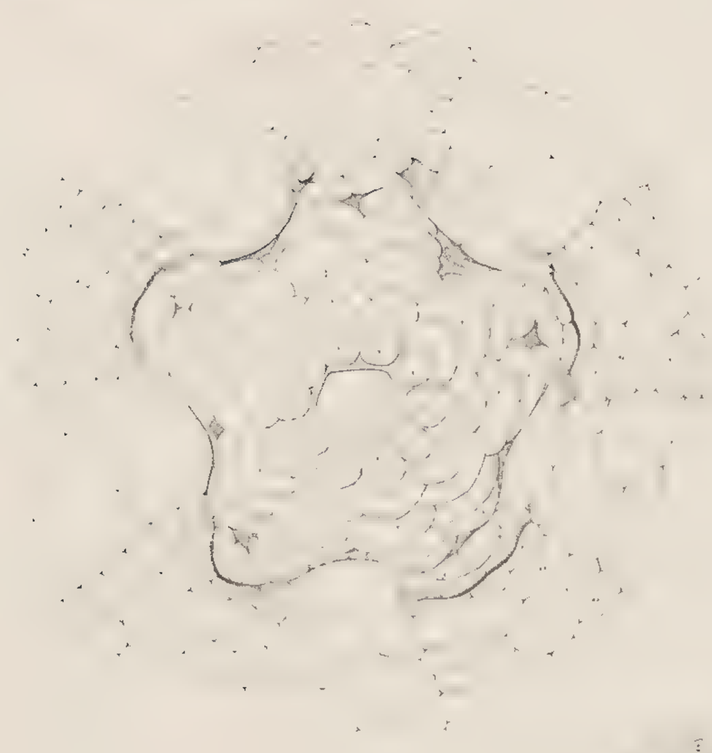
1. Actinal system of a young specimen 15 mm. in diameter, the same as Pl. 43, fig. 5, seen from the interior, showing the young auricles; Station 3362.

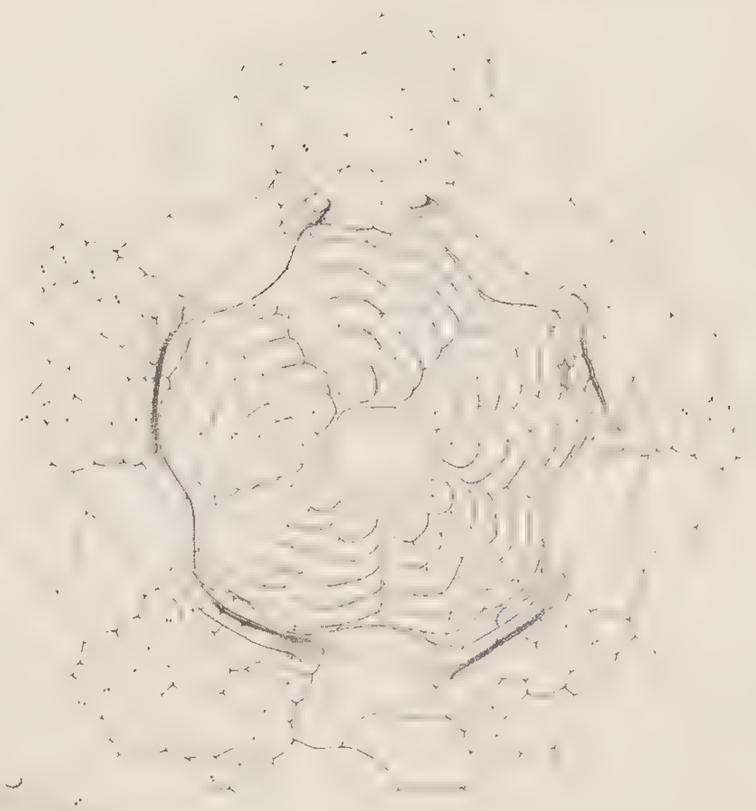
2. Interior view of the actinal system of an older specimen 43 mm. in diameter; Station 3392.

3. Interior view of actinal system and auricles of a specimen 64 mm. in diameter; Station 3375.

4. The actinal system and auricles of a specimen 137 mm. in diameter, seen from the interior; Station 3392.

5. The actinal part of the odd anterior ambulacrum of the same specimen as fig. 4, seen from the exterior.





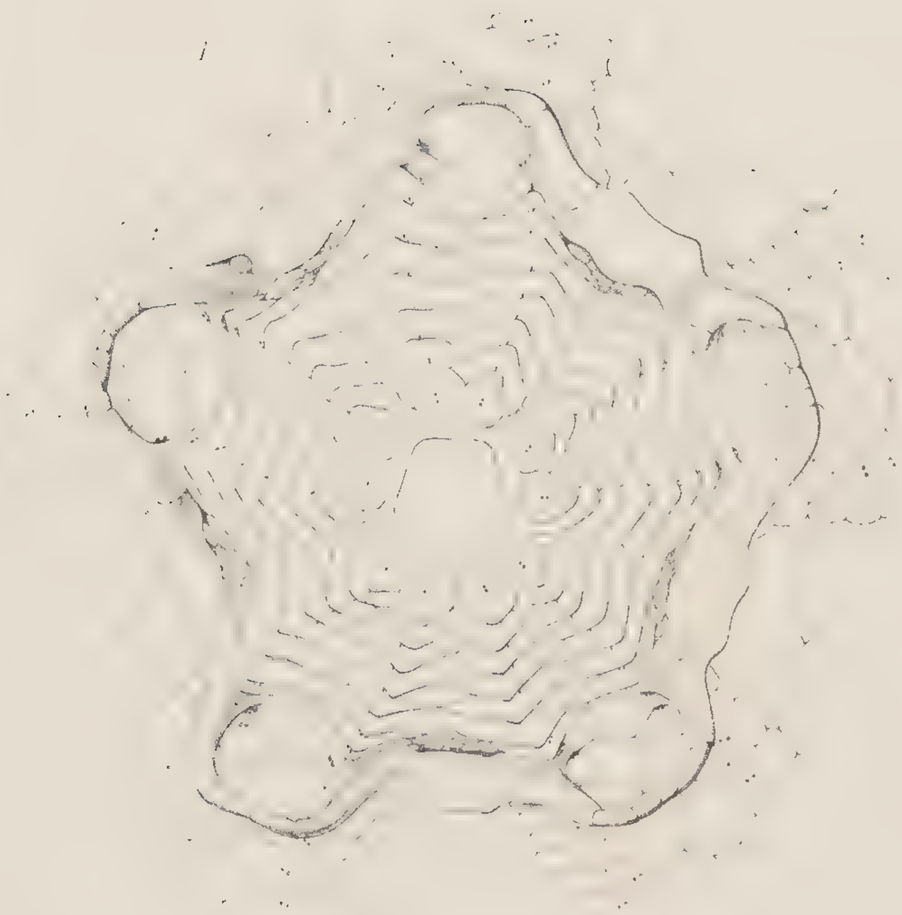


PLATE 45.

Plate 45.

1–19. Phormosoma hispidum A. Ag.

1. Auricles of odd anterior ambulacrum of young specimen 15 mm. in diameter; same as Pl. 44, fig. 1.

2. Looking towards the actinostome through the auricles of the left posterior ambulacrum of specimen measuring 43 mm. in diameter; the same as Pl. 44, fig. 2.

3. Looking towards the actinostome through the auricles of the left posterior ambulacrum of specimen 64 mm. in diameter, the same as Pl. 44, fig. 3.

4. A corresponding view of the auricles of the right posterior ambulacrum of a specimen 137 mm. in diameter; the same as Pl. 44, fig. 4.

5. The same view of the auricles of a specimen 203 mm. in diameter (Pl. 41, fig. 2).

6. Actinal plates of the right posterior ambulacrum of a specimen 53 mm. in diameter, seen from the exterior; Station 3400.

7. Interior view of the auricle and actinal plates of the left anterior ambulacrum of specimen 64 mm. in diameter; same as Pl. 45, fig. 3.

8. Actinal plates of the left anterior ambulacrum of specimen 137 mm. in diameter; the same as Pl. 45, fig. 4, seen from the exterior; Station 3392.

9. The same as fig. 8, seen from the interior.

10. Plates of the actinostome of the odd anterior ambulacrum of the same specimen.

11. First buccal plate in odd ambulacrum; one figure is seen in profile, the other is the same plate from the inside.

12. Outside view of first buccal plate of the left anterior ambulacrum.

13. Part of right posterior ambulacrum and adjoining interambulacrum from the 7th plate from the actinostome of specimen 203 mm. in diameter, seen from the exterior.

14. The same as fig. 13, seen from the interior of the test.

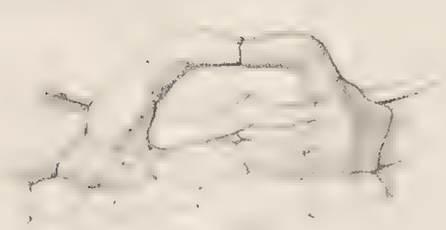
15. Primary abactinal tubercles with miliaries and secondaries of the odd interambulacrum.

16. Primary spine of an interambulacral area on the actinal side.

17. Another smaller primary spine.

18. The same spine as fig. 17, seen from the opposite side.

19. Base of same spine as fig. 16.



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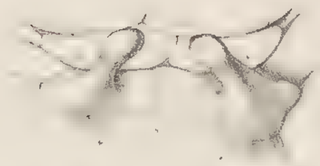

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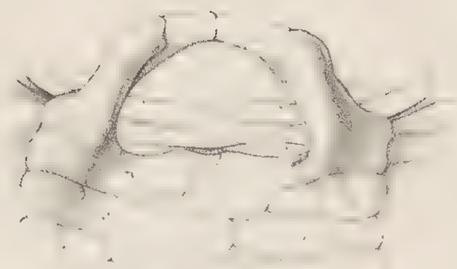

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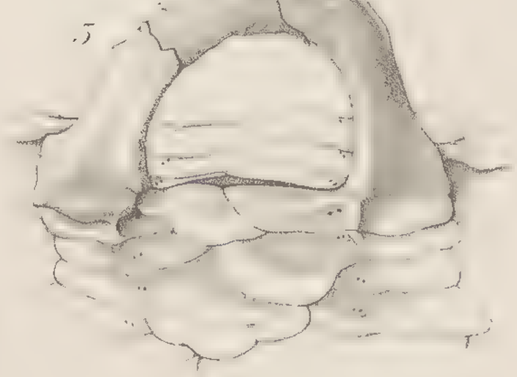

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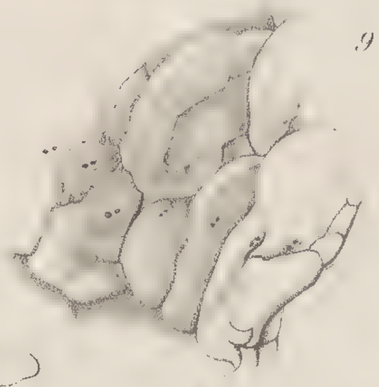

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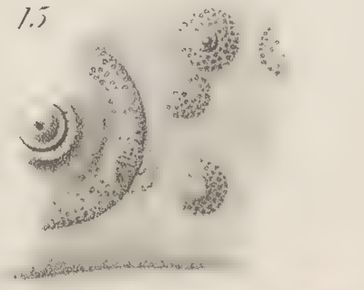

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PLATE 46.

Plate 46.

1–7. Phormosoma hispidum A. Ag.

1. The lantern in place with the imbricating plates adjoining the actinal system, seen from the interior of specimen 203 mm. in diameter; Station 3413.
2. The same as fig. 1, seen somewhat in profile.
3. Compass seen in profile.
4. The same as fig. 3, seen from above.
5. Primordial plate in the right anterior interambulacrum, of young specimen 15 mm. in diameter; Station 3362.
6. The madreporic genital showing three madreporic openings of same specimen as fig. 5.
7. The last interambulacral plate of the right anterior interambulacrum, to show the first trace of a primary tubercle of same specimen as fig. 5.

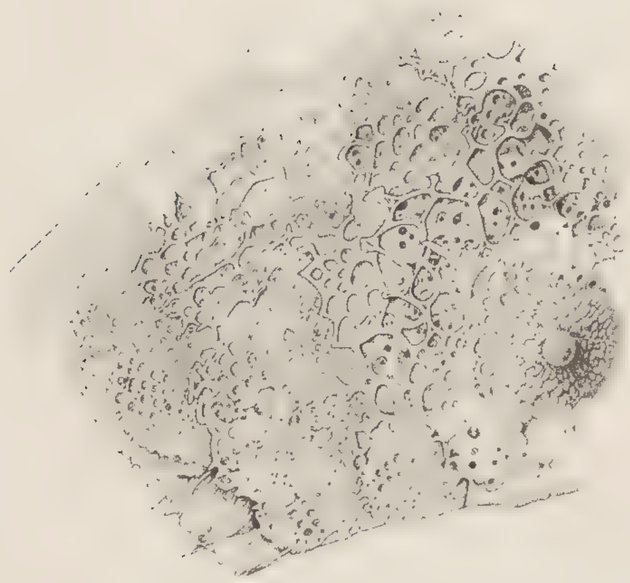


PLATE 47.

Plate 47.

1–12. Phormosoma hispidum A. Ag.

1. Lantern seen from above.

2. The same as fig. 1, seen in profile.

3. One of the pyramids, seen from the exterior.

4. The same as fig. 3, seen from the interior.

5. The same, seen in profile.

6. The same, seen from above.

7 a. Epiphysis of pyramid, from the interior.

7 b. Pyramid, in profile, from the interior.

8 a. Epiphysis of pyramid, from the outside.

8 b. Epiphysis of pyramid, in profile.

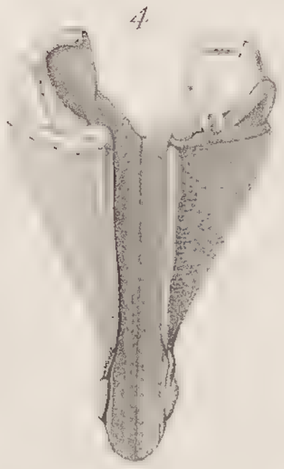
9 a. Groove of tooth; b, back of tooth; c, tooth seen in profile.

10. Upper part of tooth.

11. The same as fig. 10, seen in profile.

12 a. The brace, seen from above; b, seen in profile; c, from below; d, endwise.

3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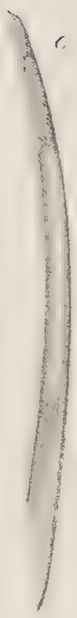
1

9

a

b


c

7

7a

b

2

12

a

b

c

d

8a

b

6

PLATE 48.

Plate 48.

1. **Phormosoma placenta** Wyv. Thoms.

1. Left posterior ambulacrum of specimen 7 mm. in diameter; "Blake" Station 150 off Nevis, 375 fms.

2–6. **Phormosoma hispidum** A. Ag.

2. Odd anterior ambulacrum of specimen 15 mm. in diameter (Pl. 30, figs. 1,) 2; Station 3362.

3. Odd anterior ambulacrum of specimen 34 mm. in diameter (Pl. 30, figs. 3, 4); Station 3362.

4. Odd anterior ambulacrum of specimen 53 mm. in diameter; Station 3400.

5. Odd anterior ambulacrum of specimen 75 mm. in diameter (Pl. 31, figs. 1, 2); Station 3392.

6. Odd anterior ambulacrum of specimen 120 mm. in diameter; Station 3431.

PLATE 49.

Plate 49.

1–5. Phormosoma hispidum A. Ag.

1. Right anterior interambulacrum of specimen 15 mm. in diameter (Pl. 30, figs. 1, 2); Station 3362.

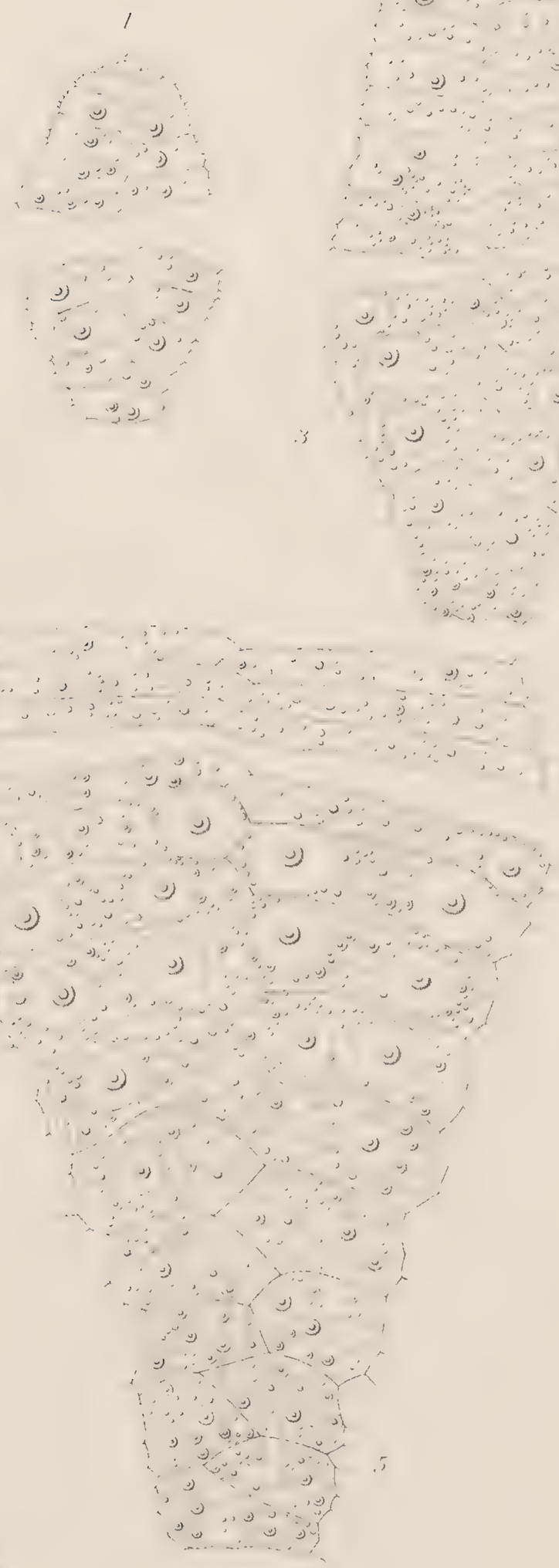
2. The same interambulacrum of specimen 34 mm. in diameter (Pl. 30, figs. 3, 4); Station 3362.

3. The same interambulacrum of specimen 53 mm. in diameter; Station 3400.

4. The same interambulacrum of specimen measuring 120 mm. in diameter; Station 3431.

5. The same interambulacrum of specimen measuring 203 mm. in diameter (Pls. 37, 38); Station 3413.

In all the figures the continuity is broken at the ambitus.



A.M. Mercereau lit

J. Meisel lith

PLATE 50.

Plate 50.

1–6. **Kamptosoma indistinctum** A. Ag.; "Challenger" Station 272.

1. Actinal system of specimen 42 mm. in diameter.

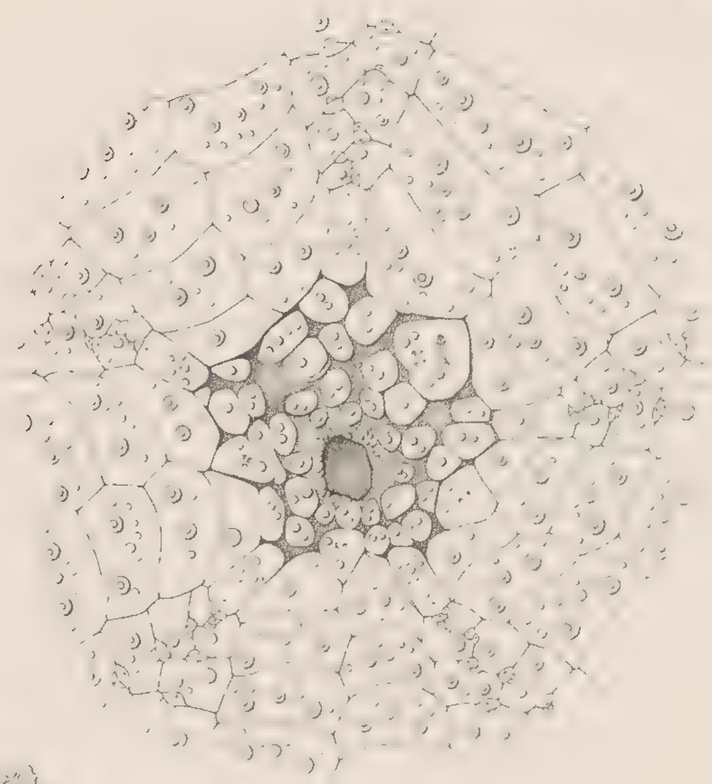
2. Abactinal system of the same specimen as fig. 1.

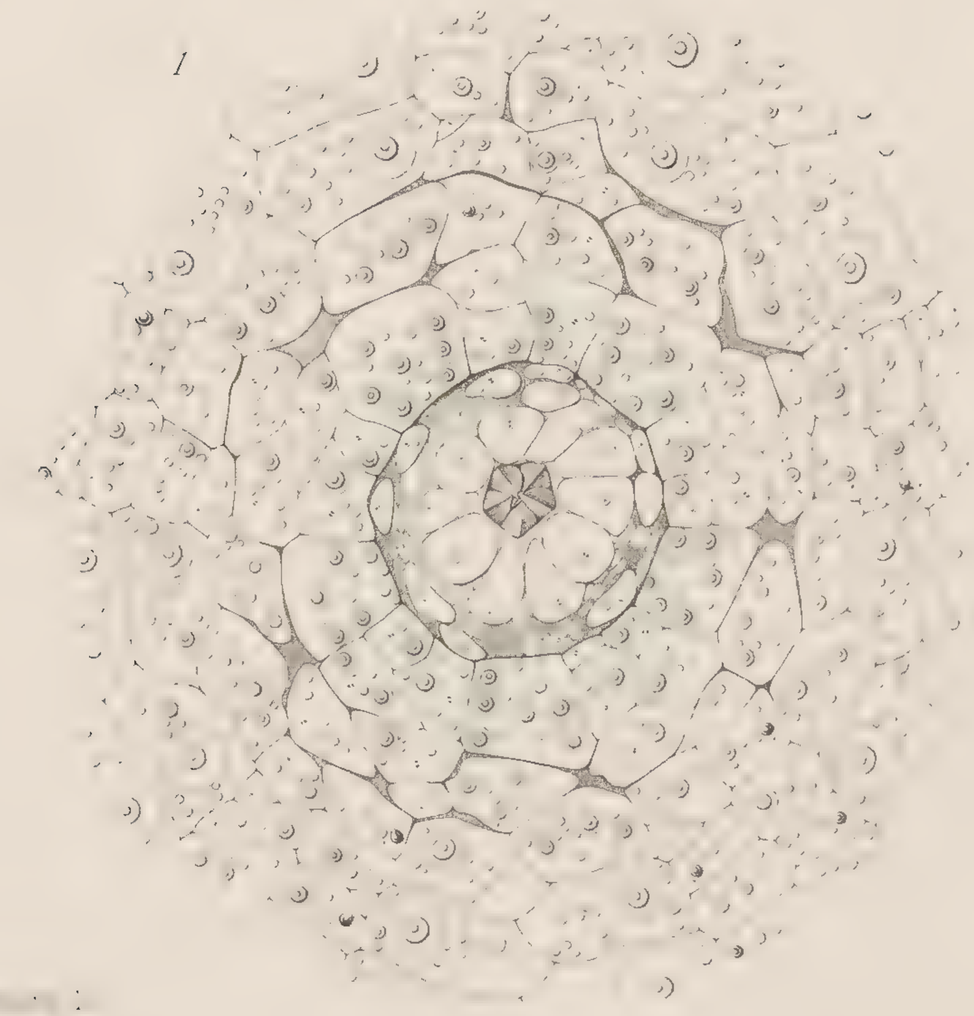
3. Odd anterior ambulacrum of the same specimen; the dotted line indicates the position of the ambitus.

4. Part of odd ambulacrum on the abactinal side; the abactinal plates are the bottom plates.

5. Part of odd ambulacrum, seen from the interior.

6. Inside view of two plates of the odd anterior ambulacrum on the actinal side near the ambitus.





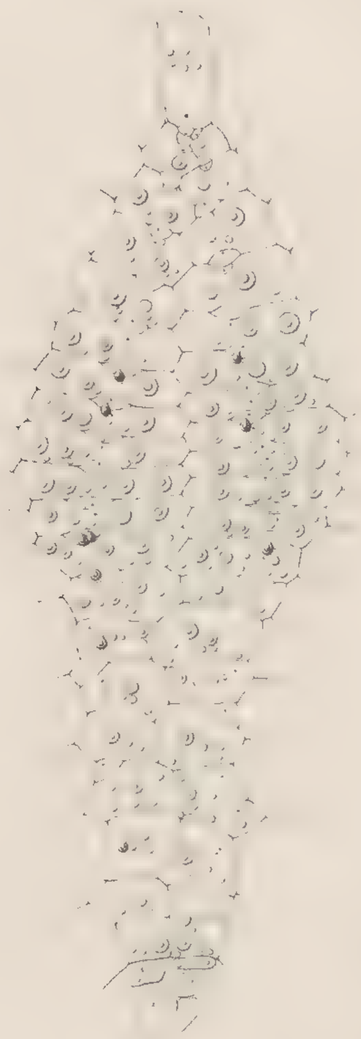


PLATE 51.

Plate 51.

1–4. **Phormosoma Zealandiæ** A. Ag.; "Challenger" Station 169.

1. Actinal system of specimen 24 mm. in diameter.

2. Abactinal system of same specimen as fig. 1.

3. Odd anterior ambulacrum of the same. The dotted line indicates the position of the ambitus.

4. Part of odd anterior ambulacrum of the same specimen as fig. 3, showing the inner row of tentacles of the double pores.

5–13. **Asthenosoma pellucidum** A. Ag.; "Challenger" Station 192.

5. Actinal system of specimen 34 mm. in diameter.

6. Abactinal system of same as fig. 5.

7. Odd anterior ambulacrum of same.

8. Actinal plates of left posterior ambulacrum of same, showing tentacles and spheridia.

9. The first three actinal plates of the odd anterior ambulacrum adjoining the actinostome of the same.

10. Plates 21 to 24 of the odd anterior ambulacrum of the same.

11. Plates 36 to 39 of the odd anterior ambulacrum of the same.

12. Plates 48 to 51 of the odd anterior ambulacrum of the same.

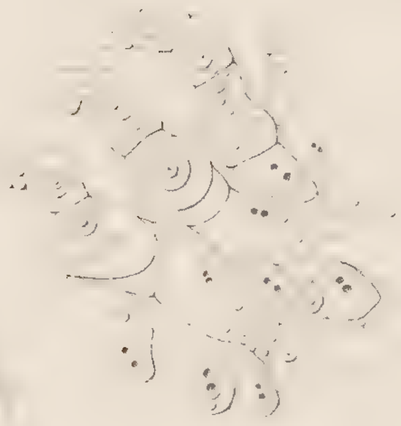
13. Plate 75 to ocular plate of the odd anterior ambulacrum of the same.

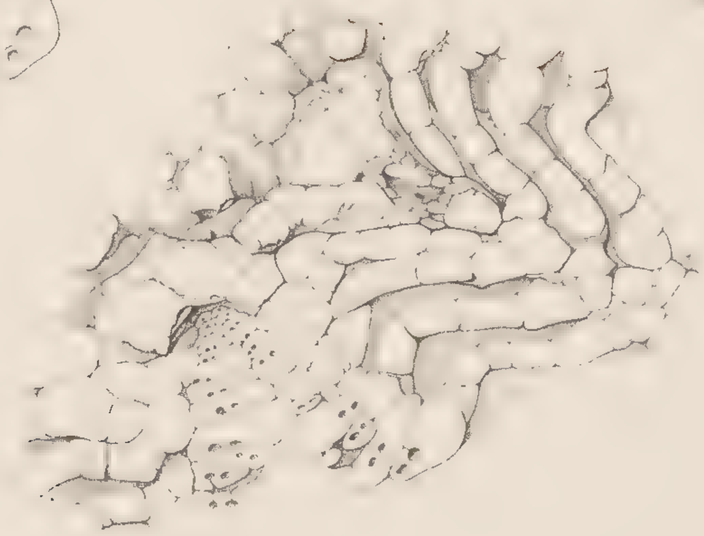
PLATE 52.

Plate 52.

1–4. **Asthenosoma coriaceum** A. Ag.; "Challenger" Station 173.

1. Abactinal system of specimen 125 mm. in diameter.
2. Abactinal part of left posterior ambulacrum and interambulacrum, seen from the interior; same specimen as fig. 1.
3. Part of left posterior ambulacrum and interambulacrum of same specimen, seen from the abactinal side.
4. The same as fig. 3, seen from the interior.





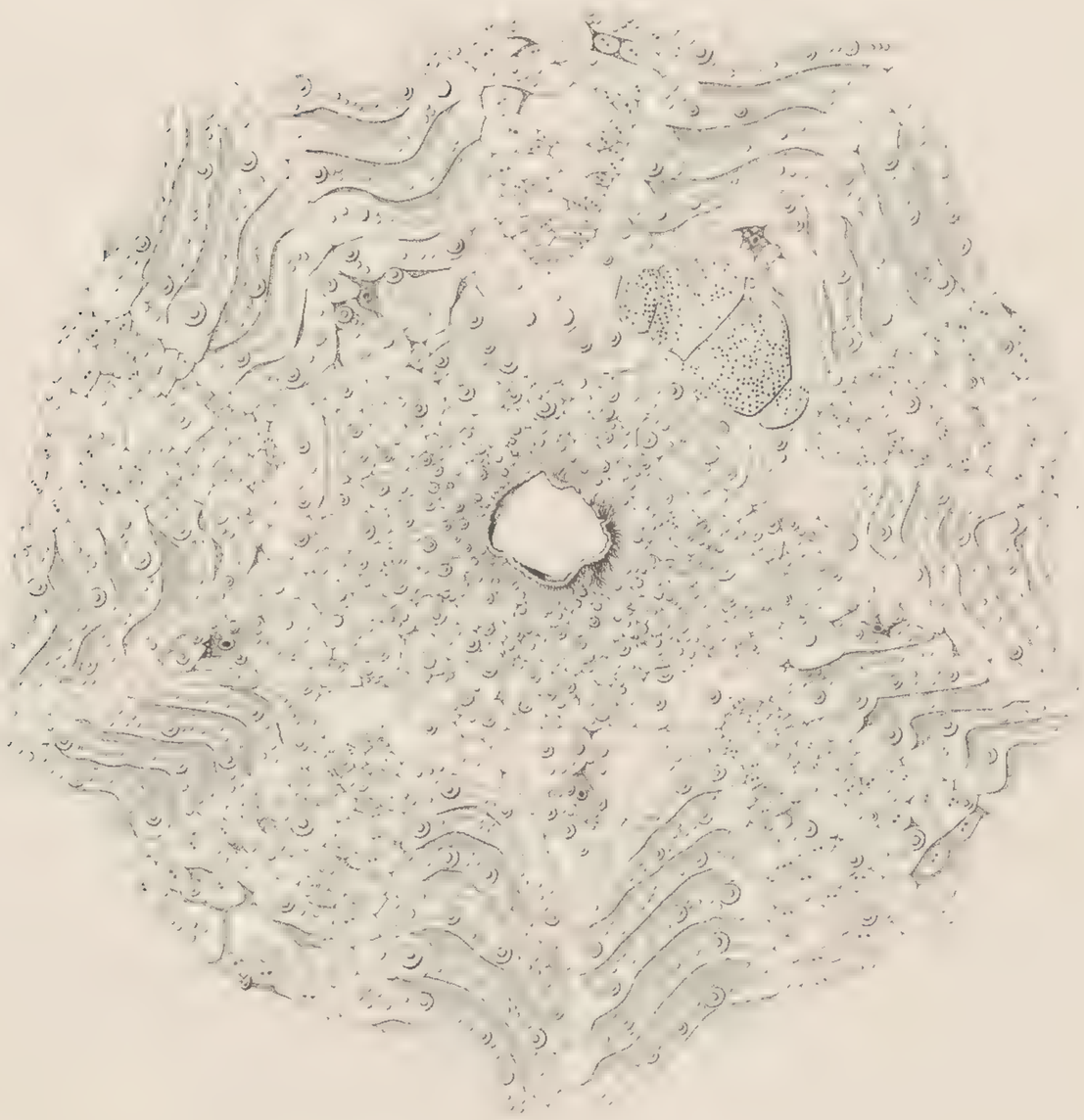


PLATE 53.

Plate 53.

1–9. Arbacia punctulata Gray.

1. Young specimen immediately after the resorption of the pluteus, seen from the actinal side, 0.8 mm. in diameter, including the spines.

2. The same as fig. 1, seen from the abactinal side. The right posterior ambulacrum is at the top in figs. 1, 2.

3. The same, seen in profile facing the left posterior interambulacrum.

4. Large odd terminal tentacle of the right posterior ambulacrum of the same.

5. The right posterior ambulacrum and part of the actinal system of the same; 1–5, Newport, 1900.

6. The odd anterior ambulacrum of a specimen 1.5 mm. in diameter, seen from the actinal side; Newport, 1872.

7. Ambulacral spine of odd anterior ambulacrum of same, seen in profile.

8. Interambulacral spine of same, seen in profile.

9. Abactinal system of young specimens 3.6 mm. in diameter; U. S. C. S. Gulf Stream Exp., 1868–69, 125 fms. off the Tortugas.

PLATE 54.

Plate 54.

1–4. Arbacia punctulata Gray.

1. Young specimen 1.5 mm. in diameter, seen from the abactinal side (same as Pl. 53, figs. 6, 7, 8); Newport, 1872.

2. Actinal system of specimen 3.6 mm. in diameter, same as Pl. 53, fig. 9; U. S. C. S. Gulf Stream Exp., 1868–69, off the Tortugas 125 fms.

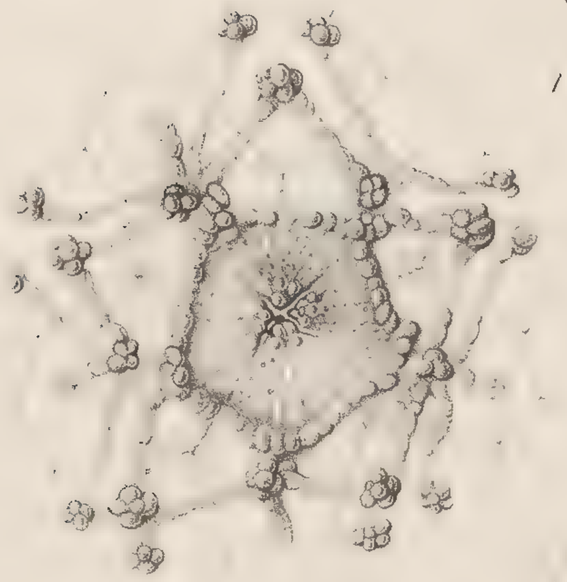
3. Abactinal part of odd anterior ambulacrum with adjoining genital plates and part of anal system, seen from the interior, same as fig. 2 and Pl. 53, fig. 9.

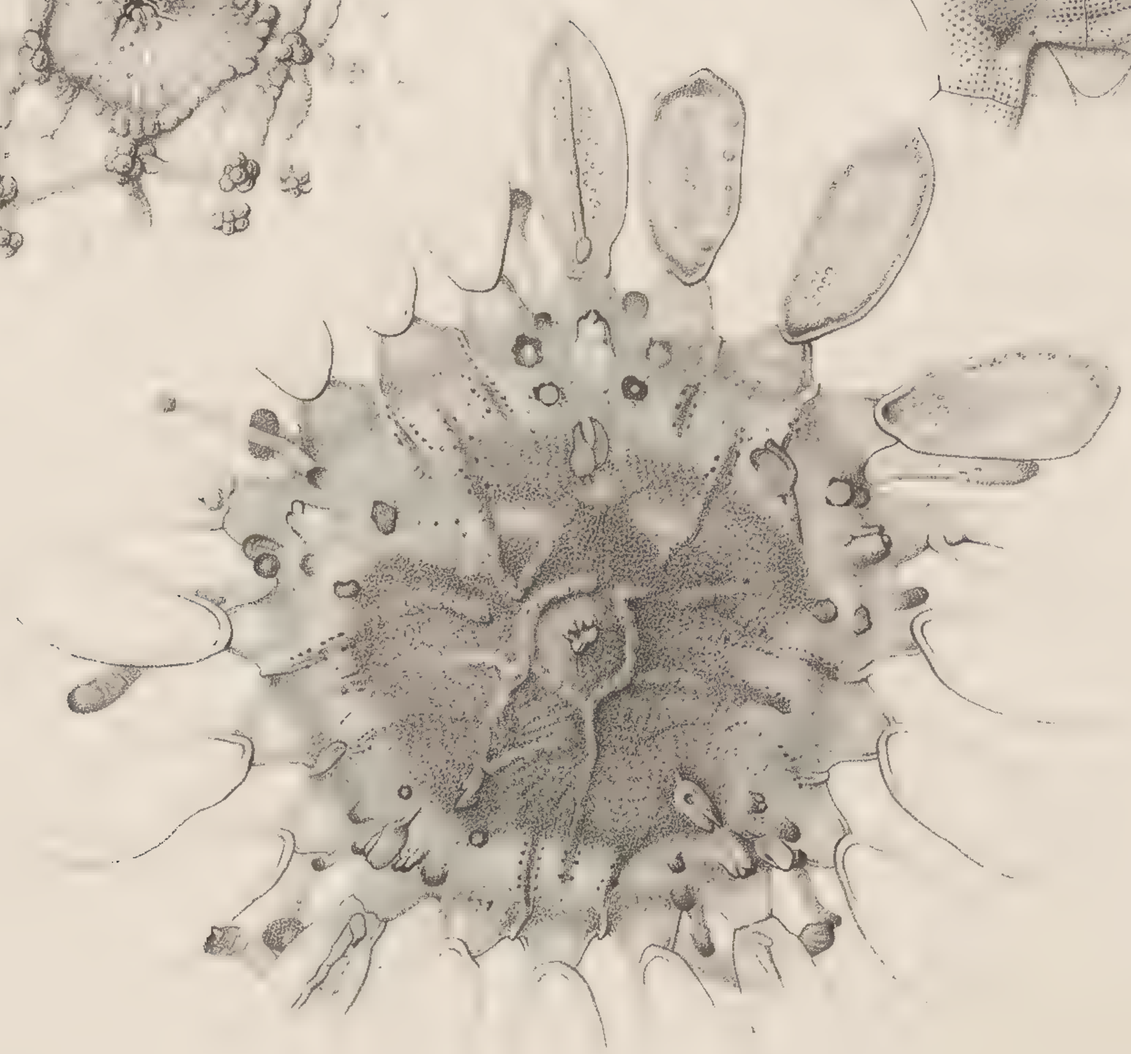
4. The abactinal system of a young specimen 2 mm. in diameter, showing the formation of the embryonic spines and ridges; off the Tortugas 125 fms.

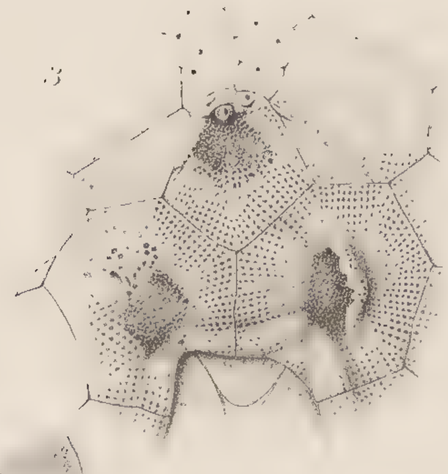
5–6. Arbacia stellata Gray.

5. Actinal plates of the odd ambulacrum and adjoining interambulacrum of specimen 16 mm. in diameter; "Hassler" Exp., Payta, Peru.

6. The same as fig. 5, seen from the interior, showing the auricles and the primordial plate.







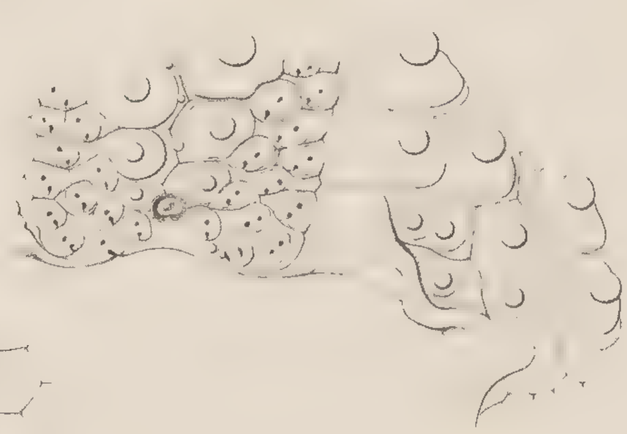


PLATE 55.

Plate 55.

1–2. **Pourtalesia Tanneri** A. Ag.; Station 3431.

1. Seen from the actinal side.

2. The same, seen in profile, facing the left posterior ambulacrum.

3–5. **Plexechinus cinctus** A. Ag.; Station 3424.

3. Seen from the actinal side.

4. The same, seen from the abactinal side.

5. The same, seen in profile, facing the left posterior ambulacrum.

6–8. **Aërope fulva** A. Ag.; Station 3361.

6. Seen from the actinal side.

7. The same, seen from the abactinal side.

8. The same, seen in profile, facing the left posterior ambulacrum.

9–10. **Homolampas hastata** A. Ag.

9. Seen from the actinal side.

10. The same, seen from the abactinal side.

All figures natural size.

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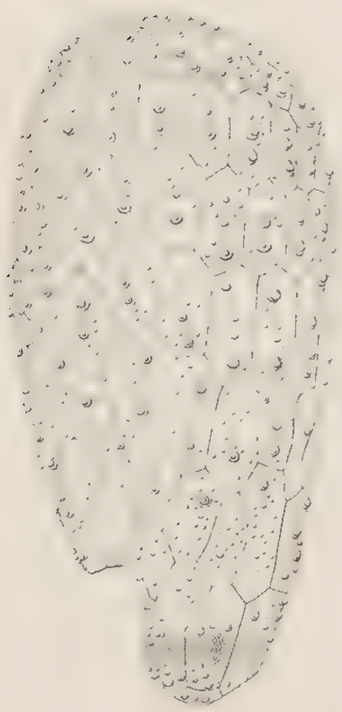
PLATE 56.

Plate 56.

1–6. **Pourtalesia Tanneri** A. Ag.; Station 3431.

1. Seen from the actinal side, 17 mm. in length.
2. The same as fig. 1, seen from the abactinal side.
3. The same in profile, seen facing the right posterior interambulacrum.
4. End view of the same, seen facing the odd anterior ambulacrum.
5. Abactinal part of test of same, surrounding the abactinal system.
6. The same as fig. 5, seen from the interior of the test.



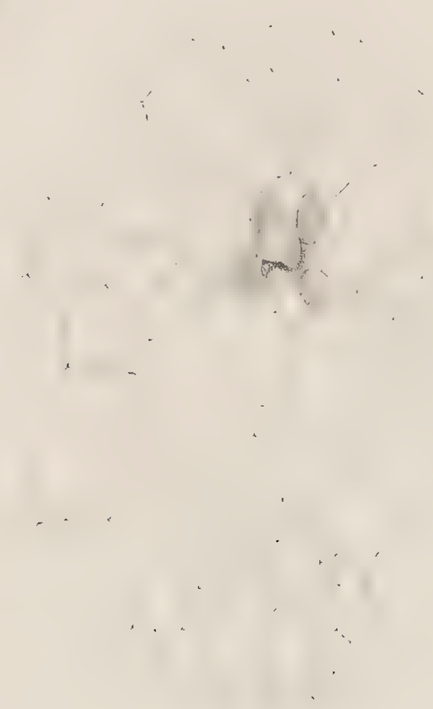


PLATE 57.

Plate 57.

1–5. **Pourtalesia Tanneri** A. Ag.; Station 3431.

1. Actinal part of the odd interambulacrum and parts of test surrounding the actinostome of a specimen 16 mm. in length.

2. The odd anterior ambulacrum and parts of test adjoining actinostome, seen from the interior, the same specimen as fig. 1.

3. Actinal parts of the odd posterior interambulacrum and adjoining parts of the test, seen from the interior facing the opening of the actinostome, the same as fig. 1.

4. The plates of the odd interambulacrum surrounding the anal opening, the same as fig. 1.

5. Development of the plates of the test surrounding the actinostome, the same as fig. 1.

PLATE 58.

Plate 58.

1–4. **Plexechinus cinctus** A. Ag.; Station 3424.

1. Specimen 20 mm. in length, seen from the actinal side.

2. The same, seen from the abactinal side.

3. The same, seen in profile facing the left posterior interambulacral area.

4. The same, end view, facing the anal system and odd posterior ambulacrum.

5. **Urechinus Naresianus** A. Ag.

5. Actinal view of specimen, 30 mm. in length; "Blake" Exp., 1878–79, Station 222, off St. Lucia.

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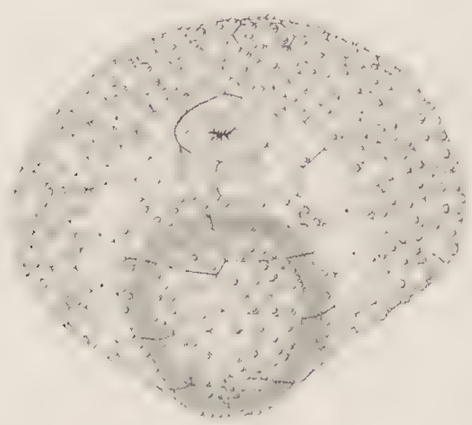

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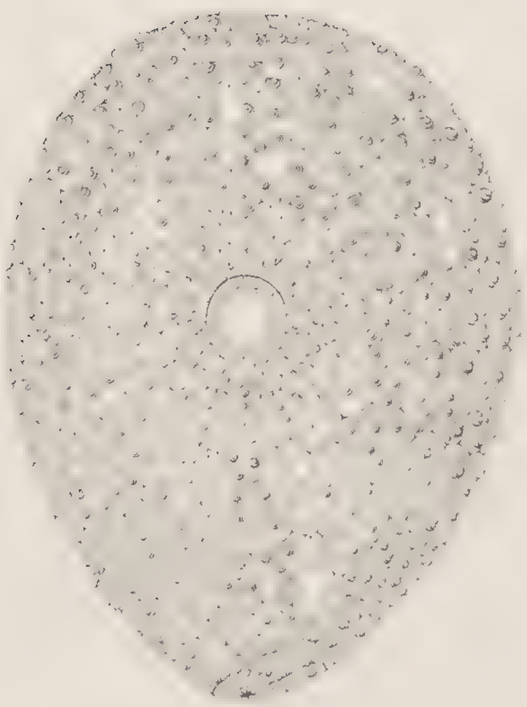

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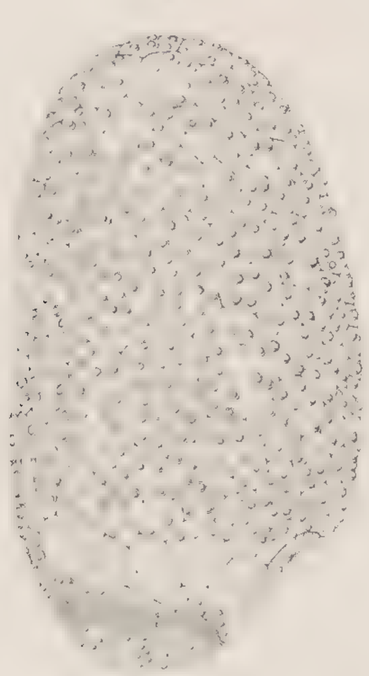

PLATE 59.

Plate 59.

1–3. **Plexechinus cinctus** A. Ag.; Station 3424.

1. Actinal system of specimen 20 mm. in diameter, the same as Pl. 58, fig. 1.

2. Anal system with surrounding interambulacral plates and part of fasciole of a specimen about 20 mm. in length (fragment).

3. Development of the coronal plates of the same as fig. 1, seen from the actinal side.

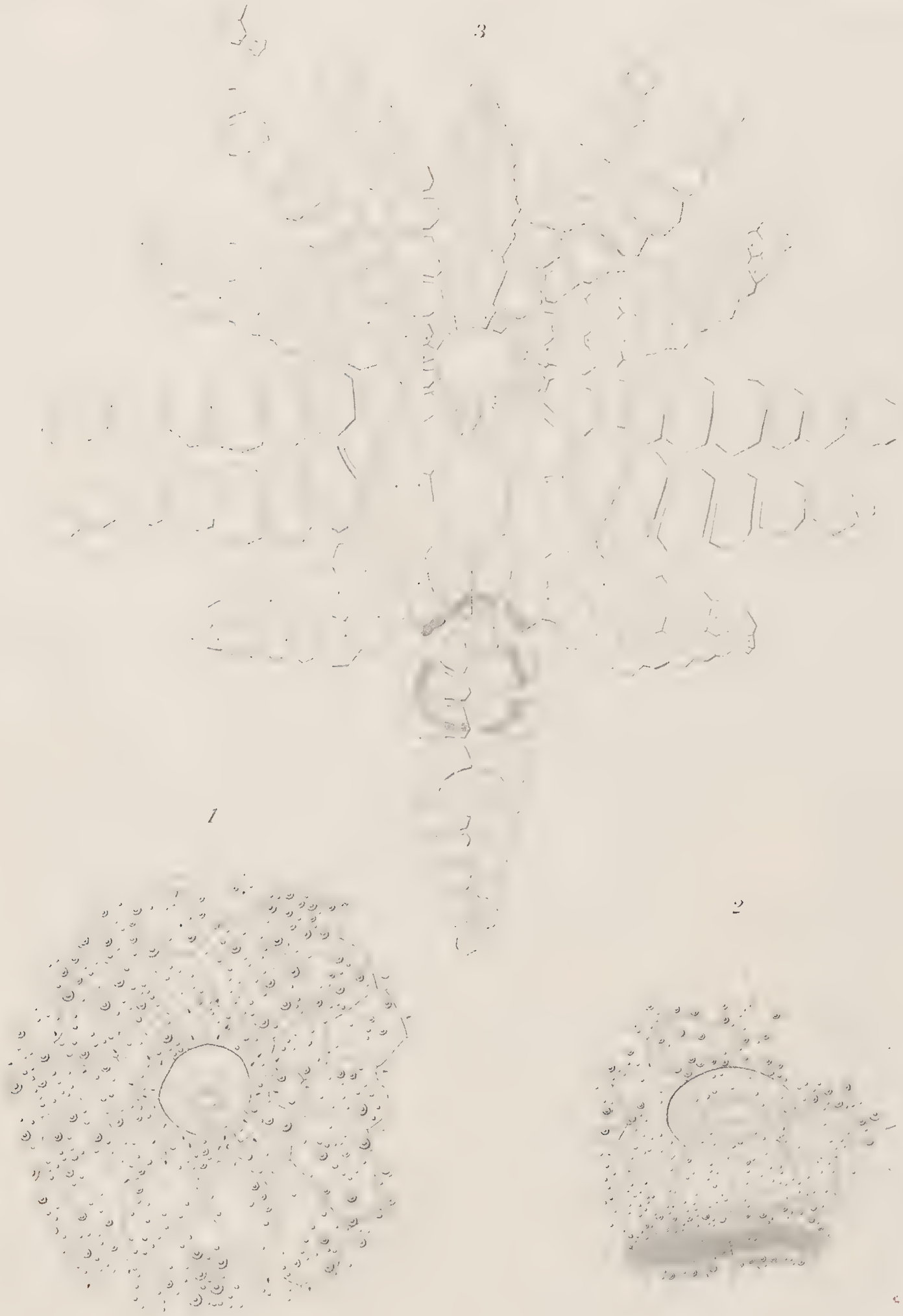
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Plate 60.

Plate 60.

1–3. **Plexechinus cinctus** A. Ag.; Station 3424.

1. Abactinal part of the test of specimen measuring 20 mm. in length, the same as Pl. 58, fig. 2.

2. Abactinal part of the test of another specimen (fragment) about 20 mm. in length, seen from the interior.

3. Abactinal plates of the odd ambulacrum; same as fig. 2, somewhat more enlarged.

4, 5. **Urechinus Naresianus** A. Ag.

4. Abactinal part of the test of specimen 30 mm. in length, the same as Pl. 58, fig. 5; "Blake" Exp., 1878–79, Station 222, off St. Lucia 422 fms.

5. Abactinal part of the test of the same specimen as fig. 4, seen from the interior.

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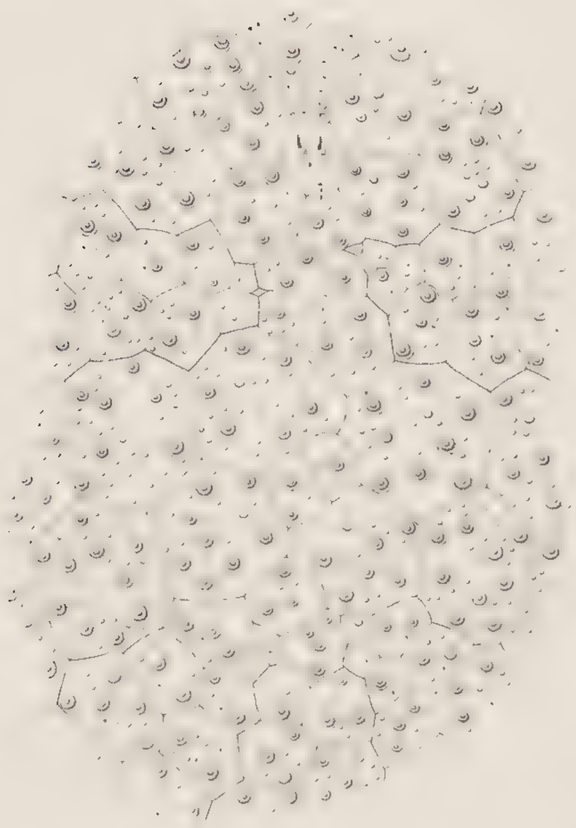

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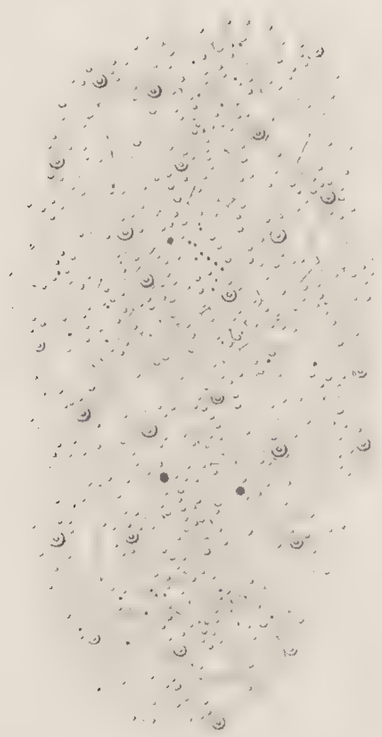

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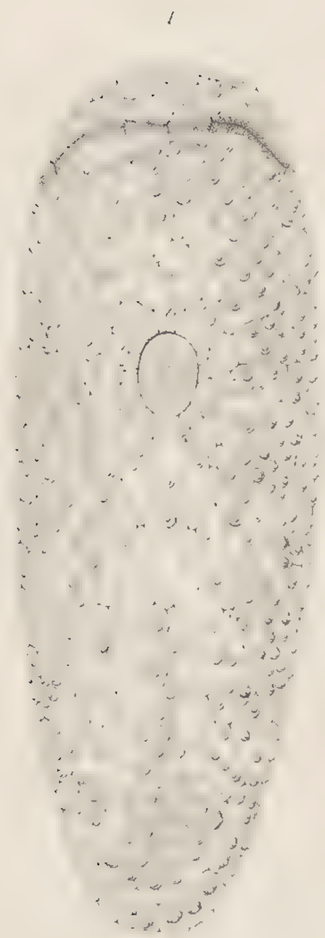
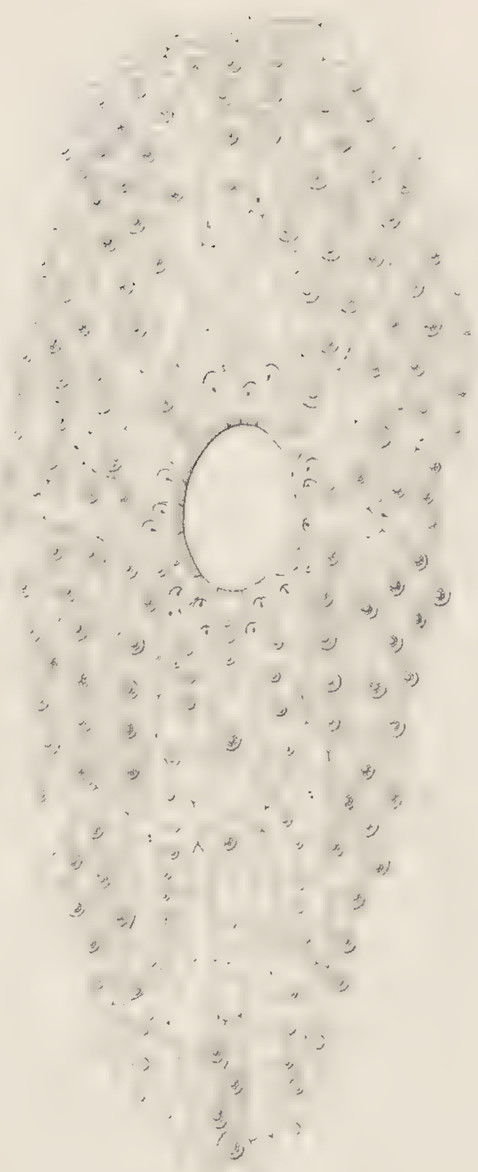
PLATE 61.

Plate 61.

1–6. Aërope fulva A. Ag.

1. Specimen 32 mm. in length, seen from the actinal side; Station 3361.
2. The same specimen, seen from the abactinal side.
3. The same, seen in profile, facing the left posterior interambulacrum.
4. End view of same, facing the odd ambulacrum.
5. End view of same, facing the anal system and odd interambulacrum.
6. Actinal plates of the test, surrounding the actinostome, of a specimen about 63 mm. in length; Station 3381.





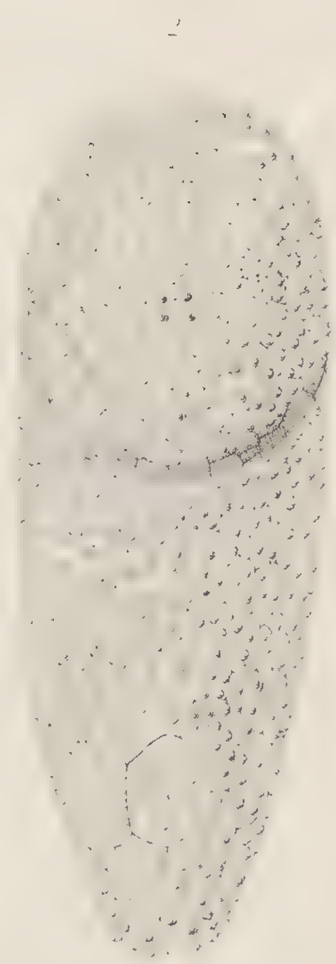


PLATE 62.

Plate 62.

1–13. Aërope fulva A. Ag.

1. Abactinal system of specimen 32 mm. in length; the same as Pl. 61, fig. 2; Station 3361.

2. Abactinal system of specimen about 48 mm. in length with only two genital openings (fragment); Station 3361.

3. Abactinal system of specimen about 50 mm. in length (fragment), seen from the interior; Station 3381.

4. Actinostome of specimen about 35 mm. in length (fragment); Station 3399.

5. Anal system of specimen about 35 mm. in length (fragment); Station 3399.

6. Ambulacral plates of the right anterior ambulacrum with fourth interambulacral plate from the actinostome, seen from the interior, showing the mode of growth of the plates; Station 3399.

7. Primary interambulacral tubercle near the actinostome; Station 3381.

8. Primary interambulacral tubercle near the ambitus, with an elongated scrobicular area; Station 3381.

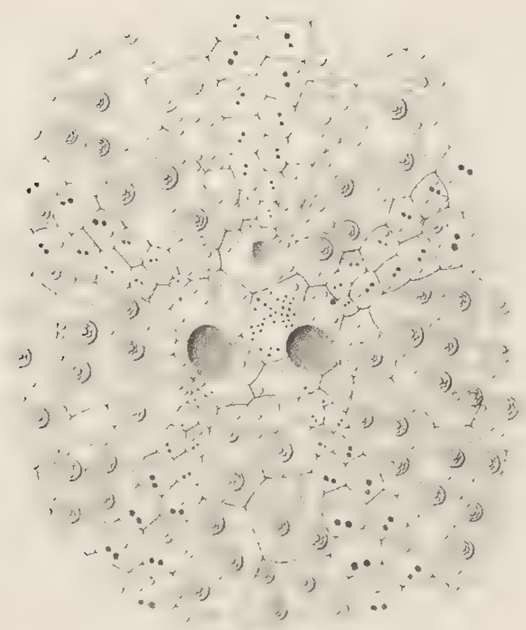
9. Primary interambulacral tubercle within the fasciole.

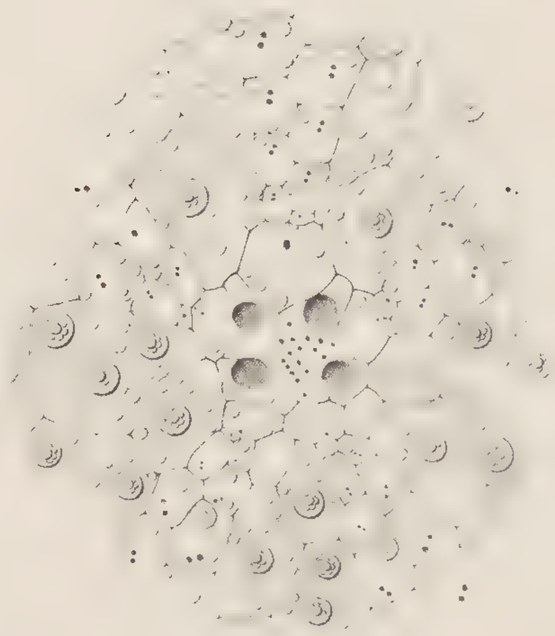
10. Primary interambulacral radiole taken from the abactinal side.

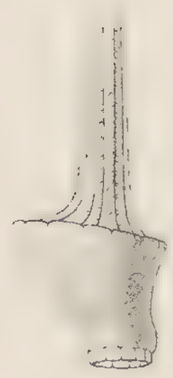
11. Primary interambulacral radiole from the ventral side.

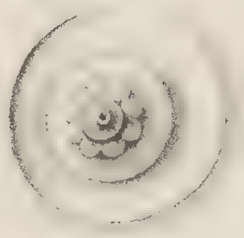
12. Fig. 10, seen in profile.

13. Base and milled ring of primary interambulacral radiole.









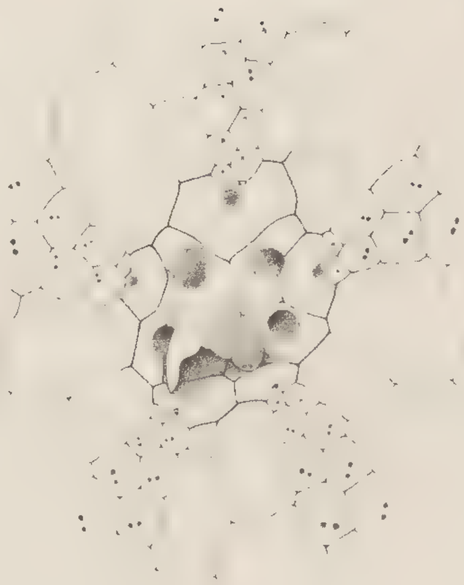


PLATE 63.

Plate 63.

1–11. **Homolampas hastata** A. Ag.

1. Abactinal view of specimen 32 mm. in length; Station 3363.

2. The same, seen in profile, facing the left posterior interambulacrum.

3. Abactinal system of the same specimen.

4. The same as fig. 3, seen from the interior.

5. The anal system of the same specimen with the surrounding plates of the odd interambulacrum.

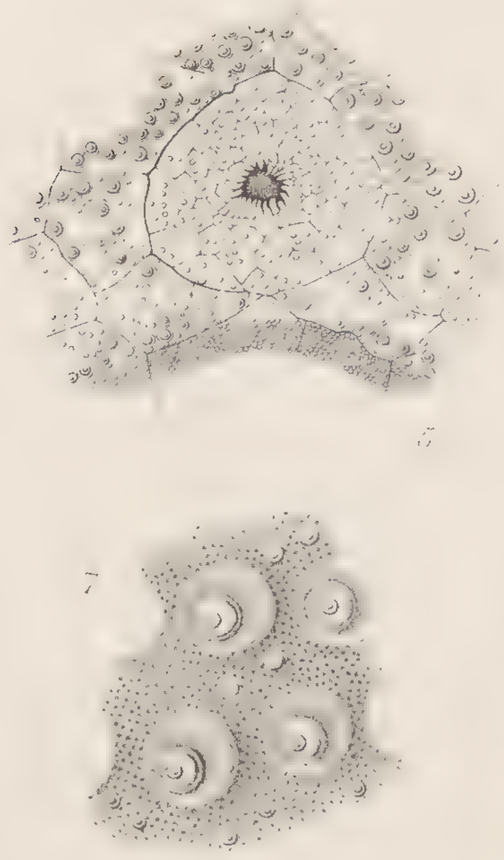
6. Actinal system of a specimen 35 mm. in diameter (fragment); Station 3376.

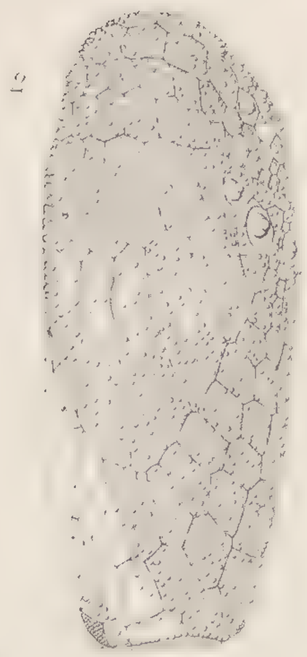
7. Primary and miliary interambulacral tubercles near the ambitus of specimen 32 mm. in length.

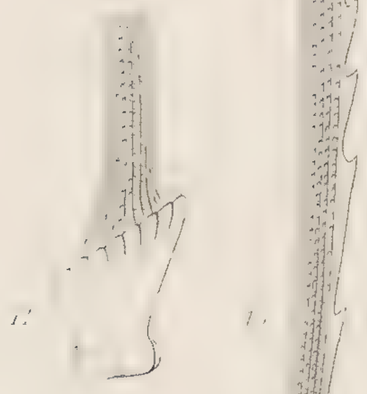
8, 9. Primary interambulacral spines of same specimen.

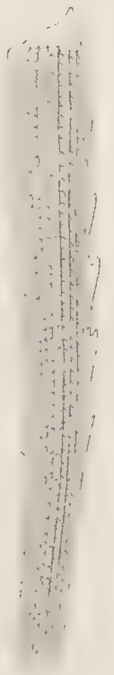
10. Primary interambulacral spine of same specimen, seen in profile.

11. Base and milled ring of fig. 10.









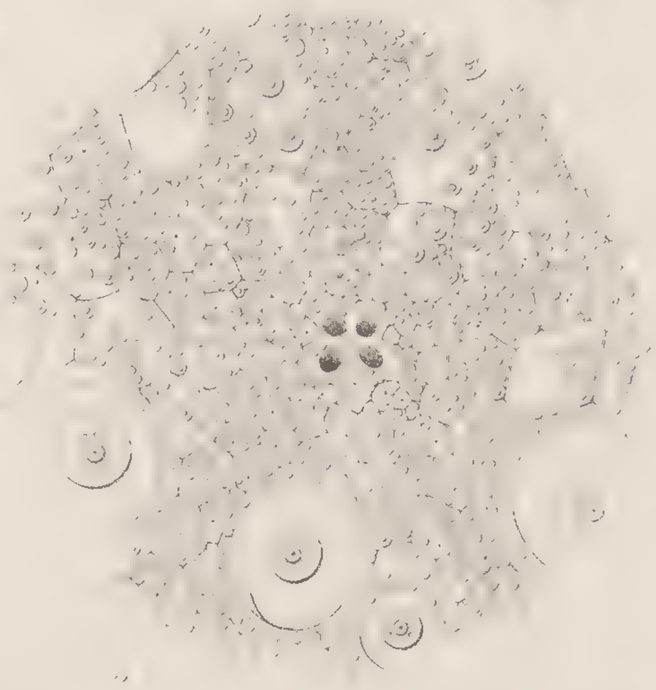


PLATE 64.

Plate 64.

1. **Homolampas hastata** A. Ag.

1. Specimen 32 mm. in length, fragment showing the left anterior ambulacrum above the ambitus and adjoining plates; Station 3363.

2–5. **Echinolampas depressa** Gray.

2. Actinostome and plates surrounding it, of specimen 4 mm. in length, seen from the interior of the test; "Blake," 1878–79, Station 253, off Grenada 92 fms.

3. Actinal plates of odd anterior ambulacrum of the same, seen from the exterior.

4. Abactinal system and plates surrounding the same, seen from the interior.

5. Abactinal system and plates surrounding the same.

6–8. **Neolampas rostellata** A. Ag.

6. Actinal system and surrounding plates of specimen 10 mm. in diameter; "Blake," 1877–78, Station 5, off Key West 229 fms.

7. Abactinal system of same.

8. Abactinal system of same, seen from the interior.

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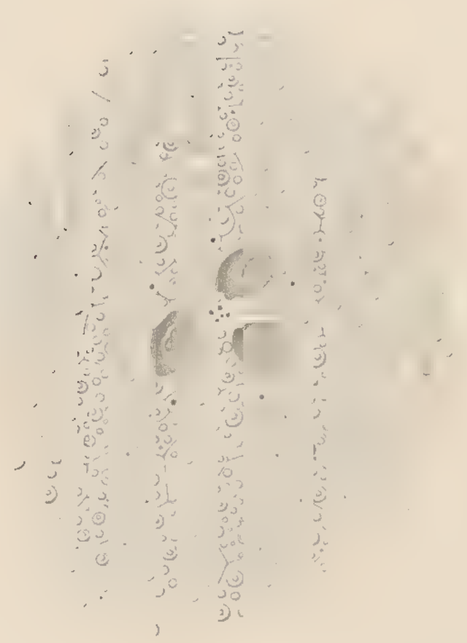

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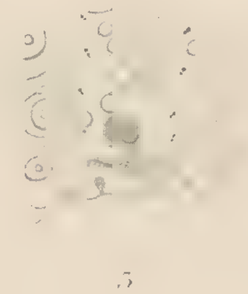

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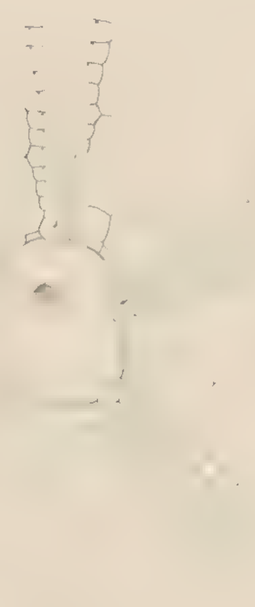

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PLATE 65.

Plate 65.

1–4. **Echinolampas depressa** Gray; "Blake," 1878–79, Station 253, off Grenada 92 fms.

1. Actinal part of odd ambulacrum of specimen 45 mm. in greatest diameter, seen from the actinal side.

2. Actinal part of test of specimen 50 mm. in greatest diameter, seen from the interior.

3. Odd anterior ambulacrum of same specimen as fig. 2, seen from the interior.

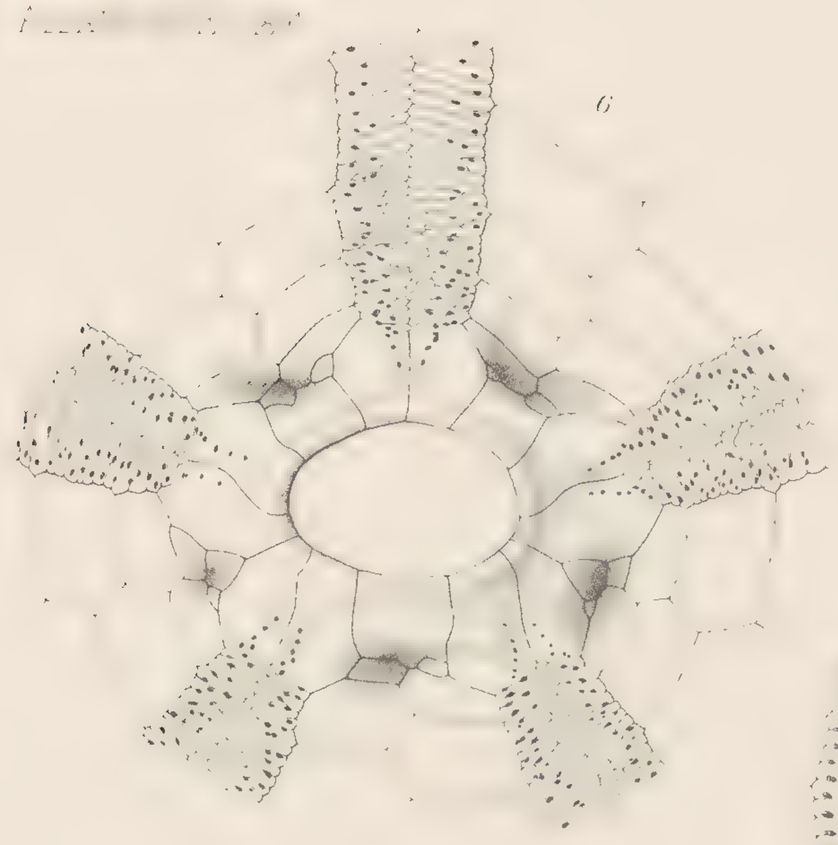
4. Abactinal part of test, seen from the interior of specimen 45 mm. in greatest diameter.

5–7. **Conolampas Sigsbei** A. Ag.

5. Actinal part of odd ambulacrum of specimen 90 mm. in greatest diameter; "Blake," 1877–78, Yucatan Bank, 84 fms.

6. Actinal part of test of same specimen as fig. 5, seen from the interior.

7. Abactinal system of same specimen, seen from the interior.



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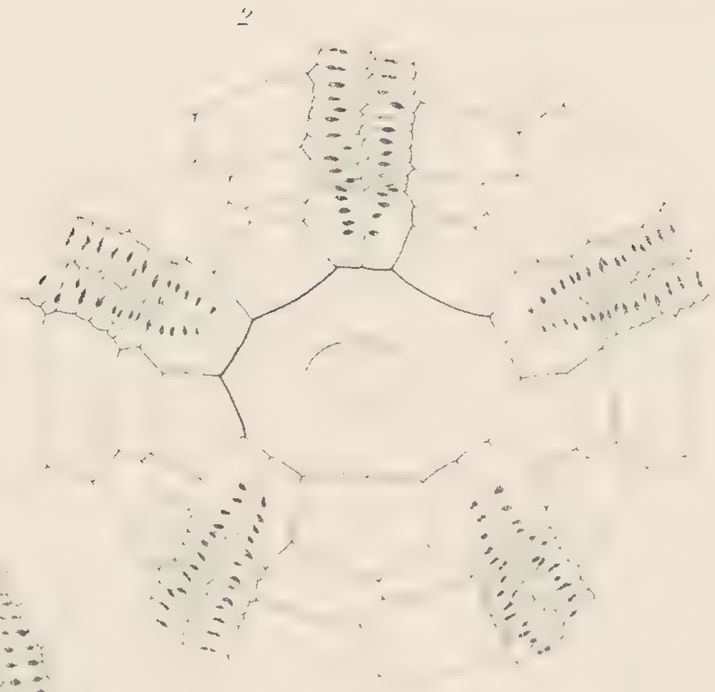

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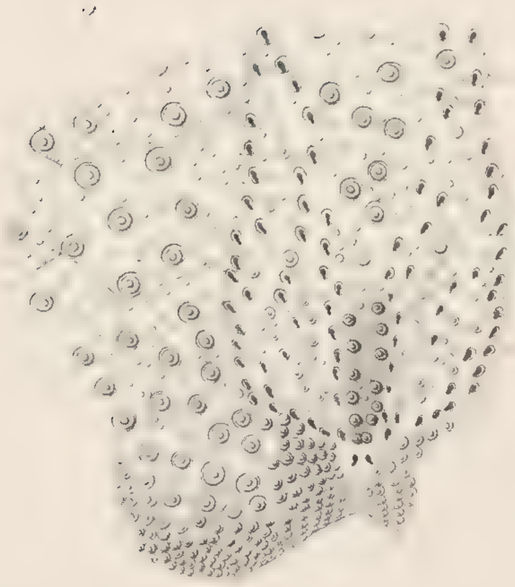

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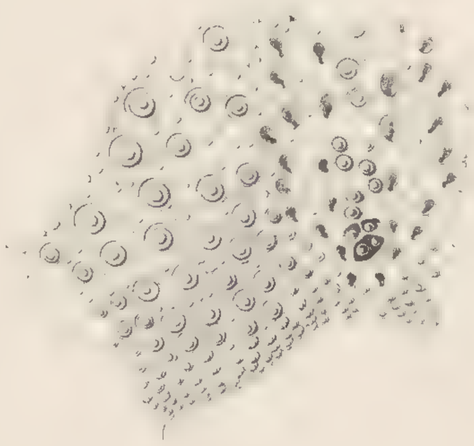

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PLATE 66.

Plate 66.

1–3. **Echinocrepis setigera** A. Ag.; Station 3399.

1. Seen from the actinal side.

2. The same, seen from the abactinal side.

3. The same in profile, seen facing the left posterior interambulacrum.

All figures natural size.

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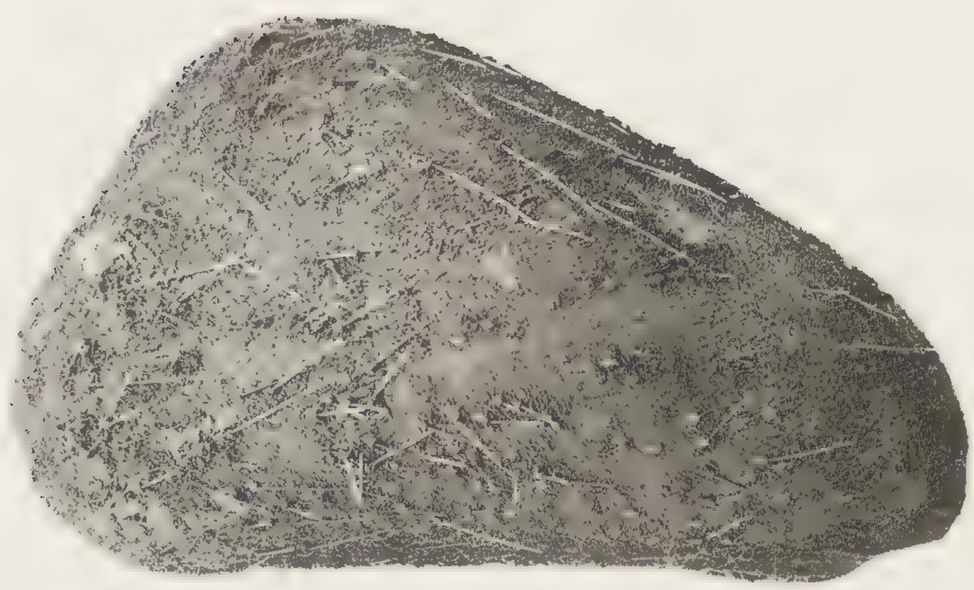
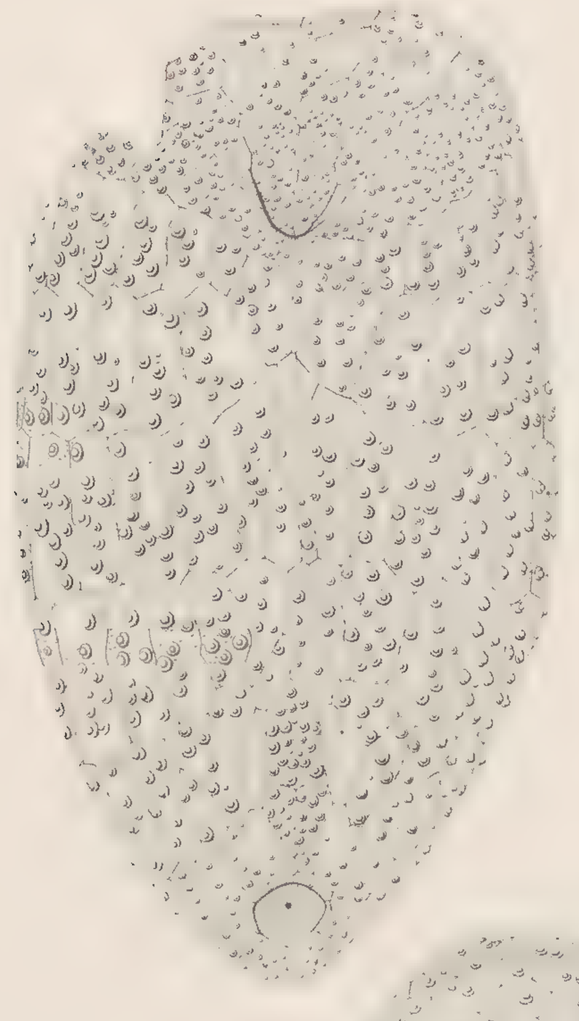


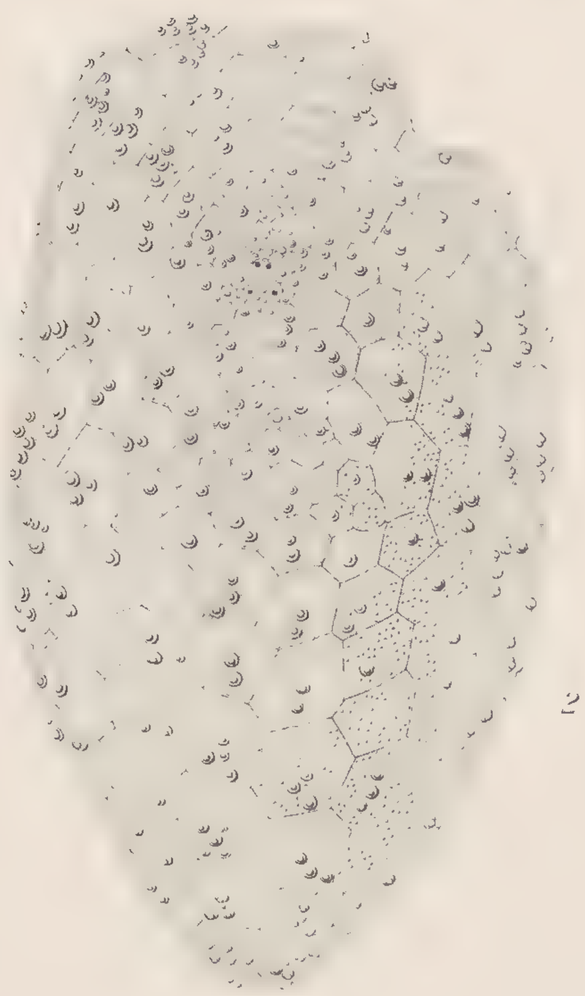
PLATE 67.

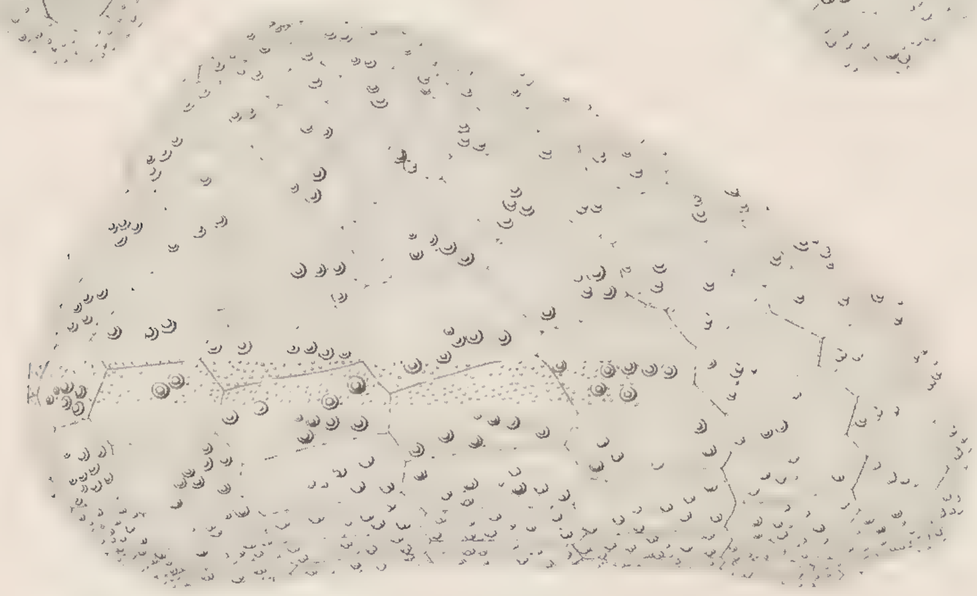
Plate 67.

1–5. **Echinocrepis setigera** A. Ag.; Station 3399.

1. Denuded test of specimen 92 mm. in length (Pl. 66, fig. 1), seen from the actinal side.
2. The same specimen, seen from the abactinal side (Pl. 66, fig. 2).
3. The same, seen in profile facing the left posterior interambulacrum (Pl. 66, fig. 3).
4. End view of same specimen, facing the odd anterior ambulacrum.
5. End view of same specimen, facing the anal system and the odd interambulacrum.







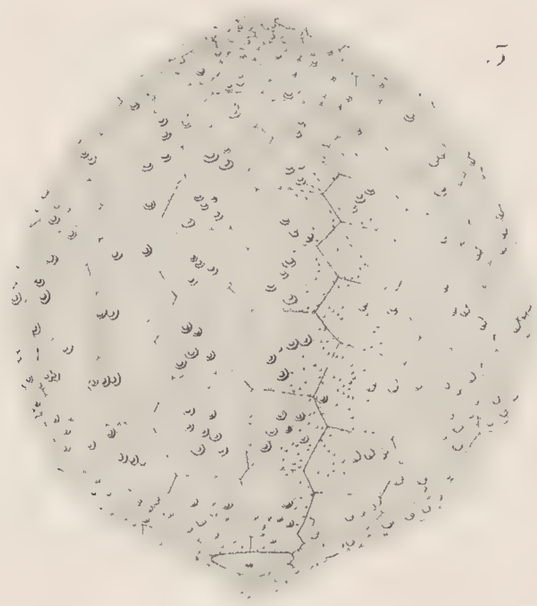


PLATE 68.

Plate 68.

1–5. **Echinocrepis setigera** A. Ag.; Station 3399.

1. Interior view of the actinal face of specimen 92 mm. in length (Pl. 67, fig. 1).

2. Interior view of abactinal face of same specimen (Pl. 67, fig. 2).

3. Enlarged view of anal system and posterior part of test, seen from the actinal side of same specimen (Pl. 67, fig. 1).

4. Enlarged view of apical part of the posterior ambulacra and odd interambulacrum of the same specimen as fig. 2, seen from the interior.

5. Primary interambulacral tubercle with surrounding secondaries and miliaries of an actinal plate from the left posterior interambulacrum.

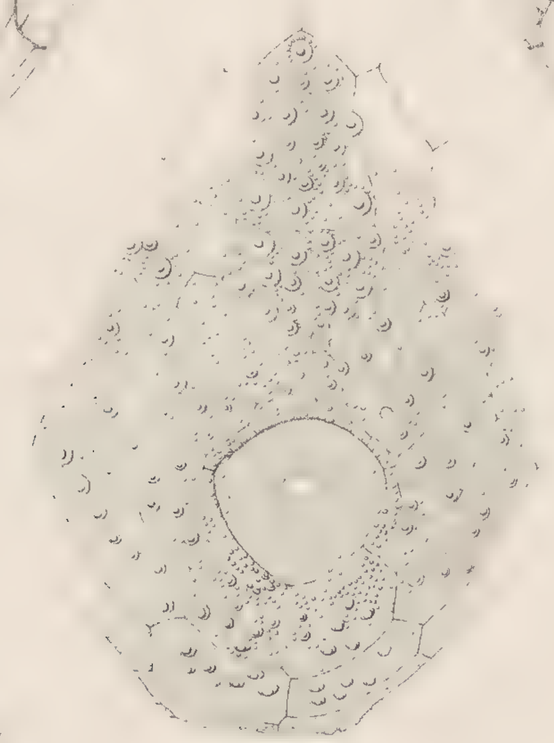


Plate 69.

Plate 69.

1–5. **Echinocrepis setigera** A. Ag.; Station 3399.

1. Actinostome with surrounding plates, seen from the interior, facing the odd anterior ambulacrum of specimen 92 mm. in length.

2. The same as fig. 1, seen obliquely from the interior, showing the plates of the odd and anterior ambulacra and of the adjoining anterior interambulacra.

3. Enlarged view of abactinal system of same specimen (Pl. 67, fig. 2).

4. The same as fig. 3, seen from the interior (Pl. 68, fig. 2).

5. Development of the actinal plates of same specimen, seen from the interior (Pl. 68, fig. 1).

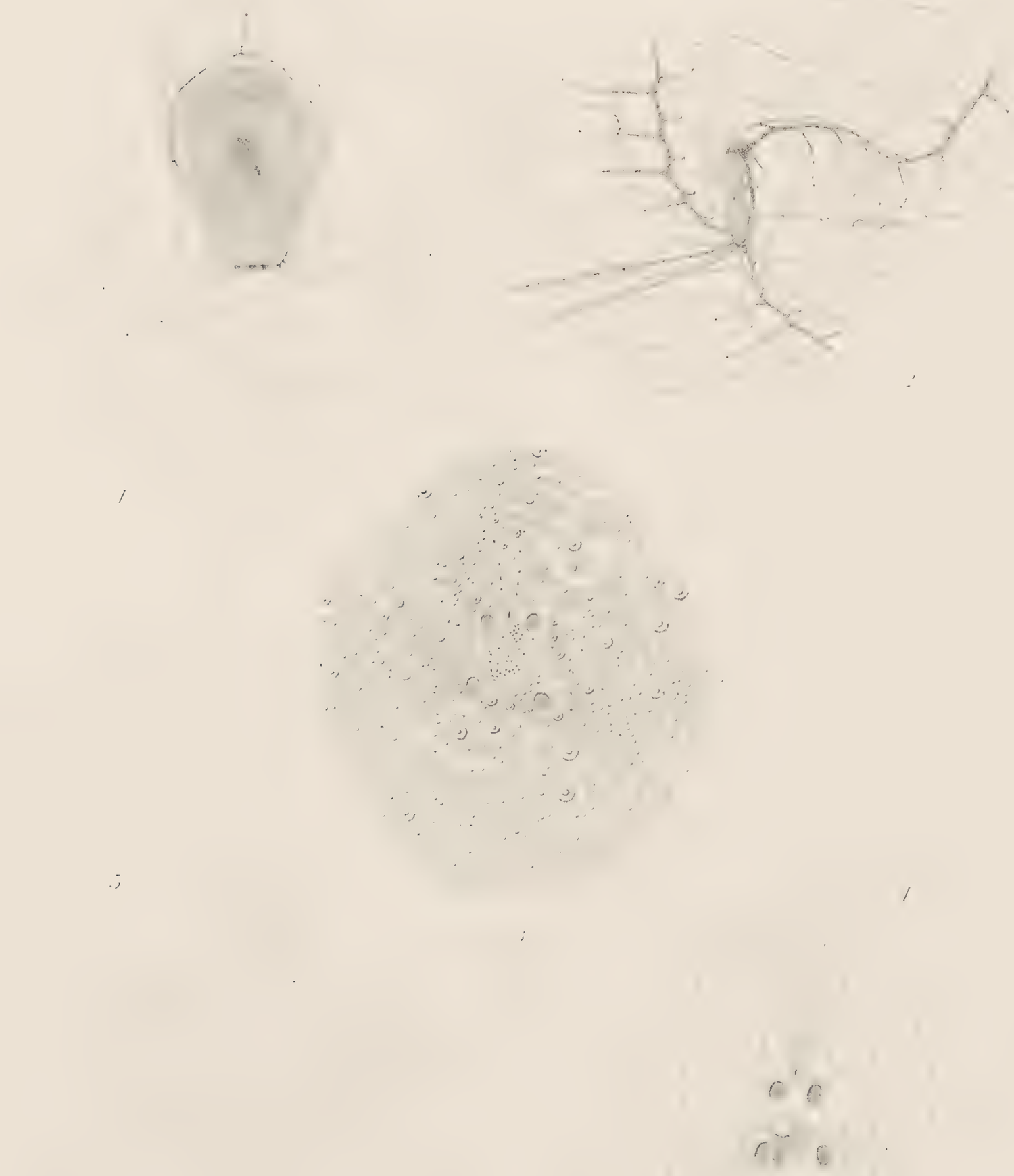
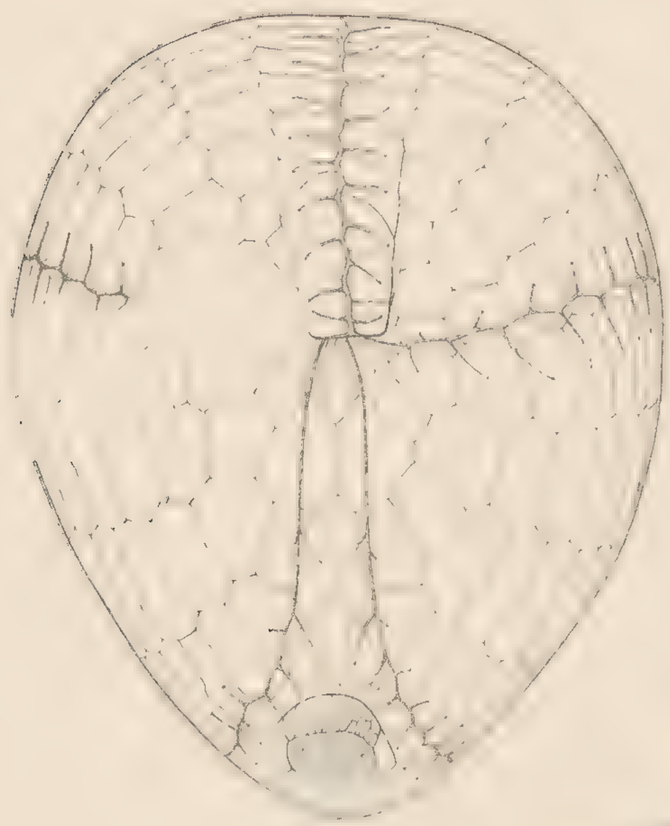


PLATE 70.

Plate 70.

1–5. **Spatagocystis Challengeri** A. Ag.; "Challenger" Station 147.

1. Specimen 48 mm. in length, seen from the actinal side.
2. The same, seen from the interior.
3. The same, seen from the interior of the abactinal side.
4. Actinostome and plates surrounding the same.
5. Anal system and posterior extremity of the same.



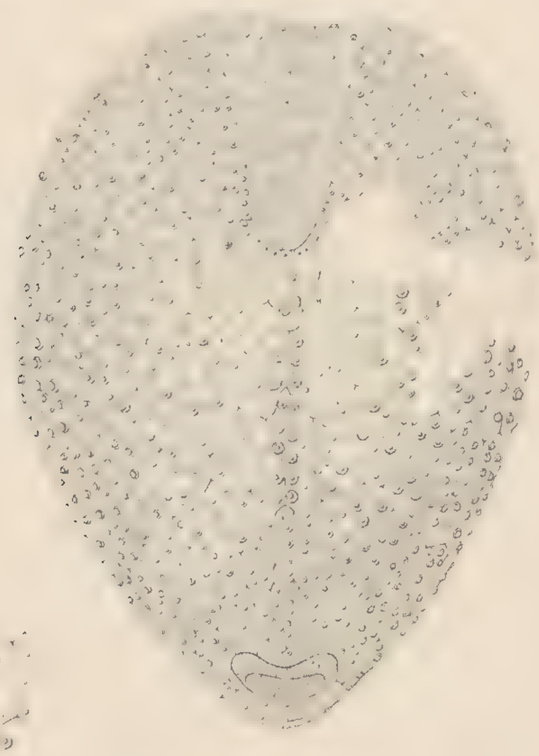


PLATE 71.

Plate 71.

1–7. **Spatagocystis Challengeri** A. Ag.; "Challenger" Station 147.

1. From the interior, seen facing the actinostome of specimen 48 mm. in length.

2. The same as fig. 1, seen in profile from the interior, facing the right anterior ambulacrum.

3. Abactinal system of same specimen.

4. The same as fig. 3, seen from the interior.

5. The anal system of the same specimen, seen from the interior, showing the surrounding plates of the odd interambulacrum and the course and position of the plates of the adjoining posterior interambulacra.

6. Development of the coronal plates of the actinal side surrounding the actinostome of the same specimen.

7. Showing the primary, secondary, and miliary tubercles of the third plate from the mouth of the right anterior ambulacrum of the same specimen.

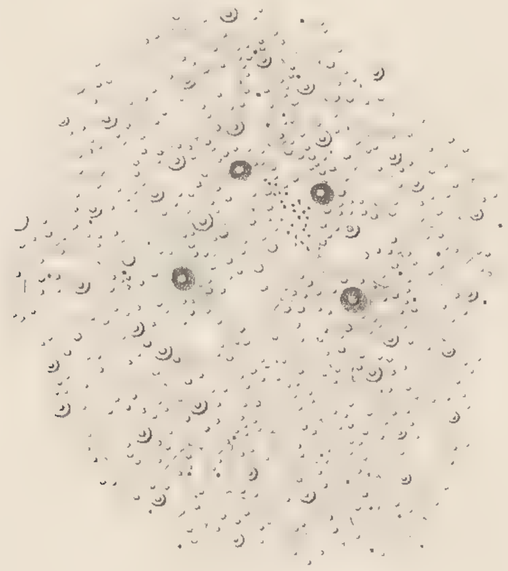


PLATE 72.

Plate 72.

1–3. **Urechinus giganteus** A. Ag.; Station 3431.

1. Seen from the actinal side.

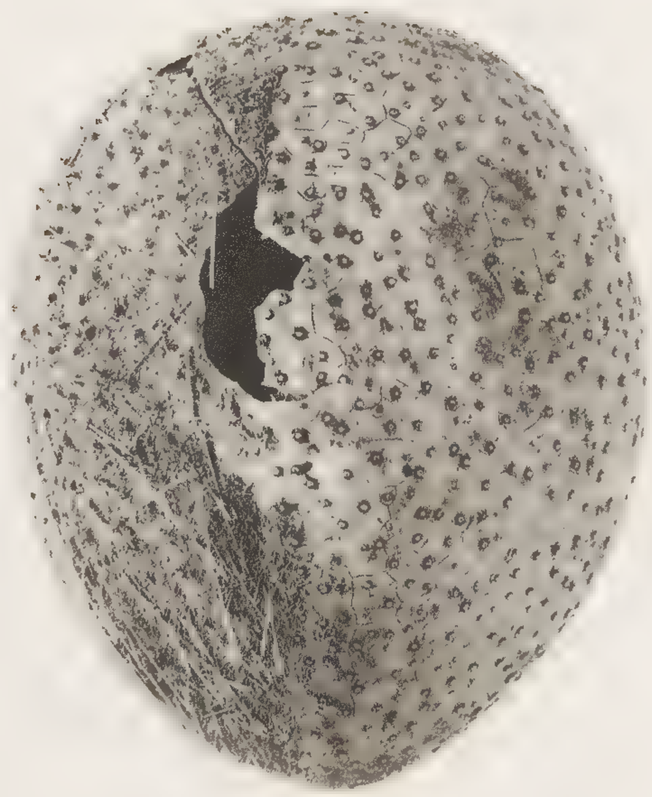
2. The same specimen, seen from the abactinal side.

3. The same, seen in profile, facing the right posterior ambulacrum.

All figures natural size.

1

2



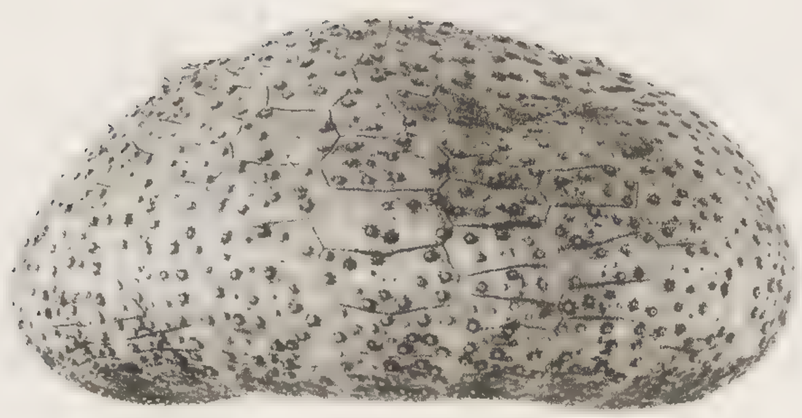


Plate 73.

Plate 73.

1–5. Urechinus giganteus A. Ag.; Station 3431.

1. Actinal system and surrounding plates of specimen 80 mm. in length, showing resorption of miliaries in the posterior ambulacra.

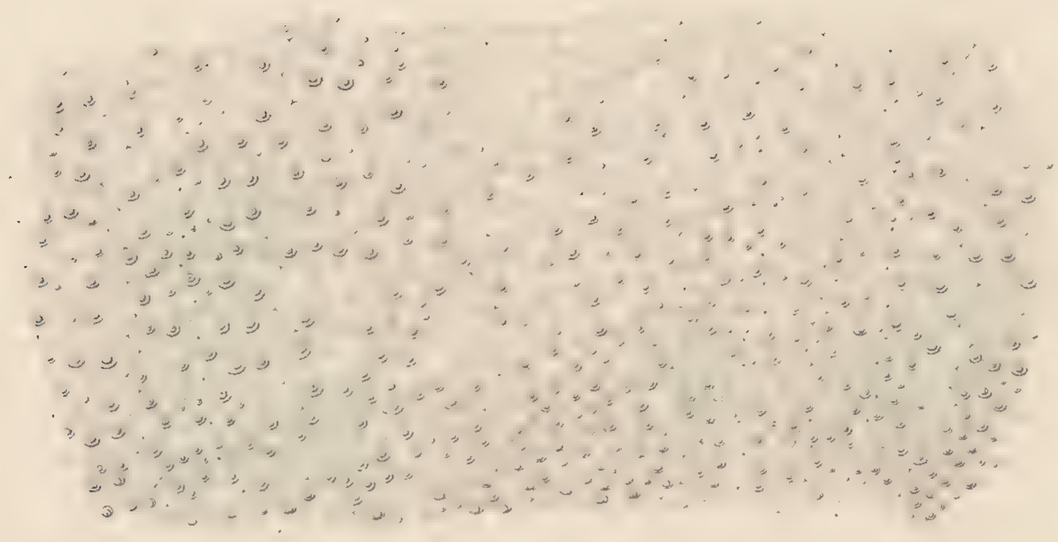
2. Part of test of specimen 80 mm. in length, facing the right posterior interambulacrum, showing resorption of tubercles.

3. Part of test of same specimen, near ambitus, facing the right anterior ambulacrum.

4. The third plate from the actinostome of the left posterior interambulacrum, to show resorption of tubercles.

5. Anal system of same.

2



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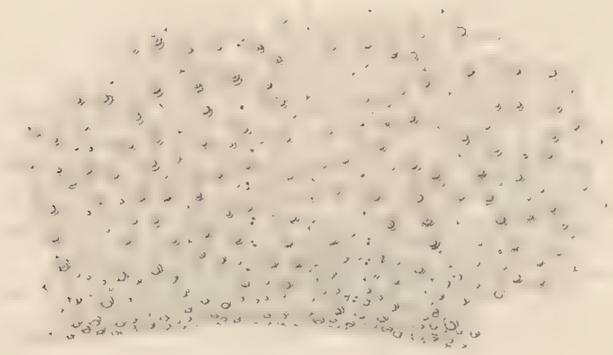
3



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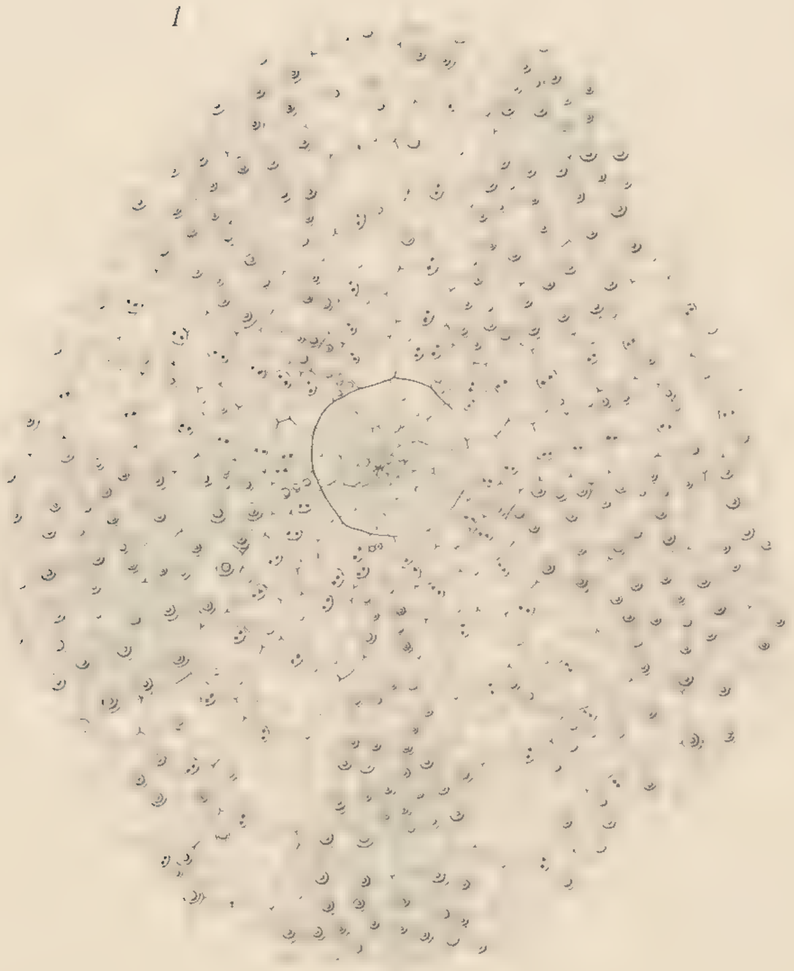

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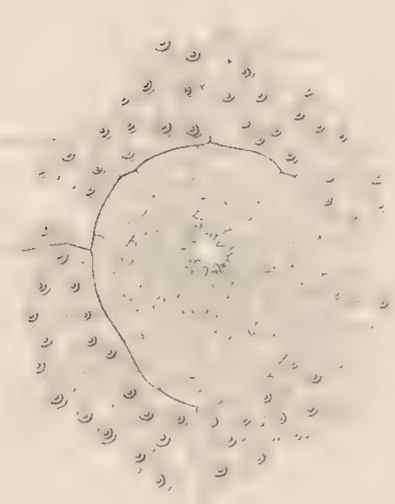


Plate 74.

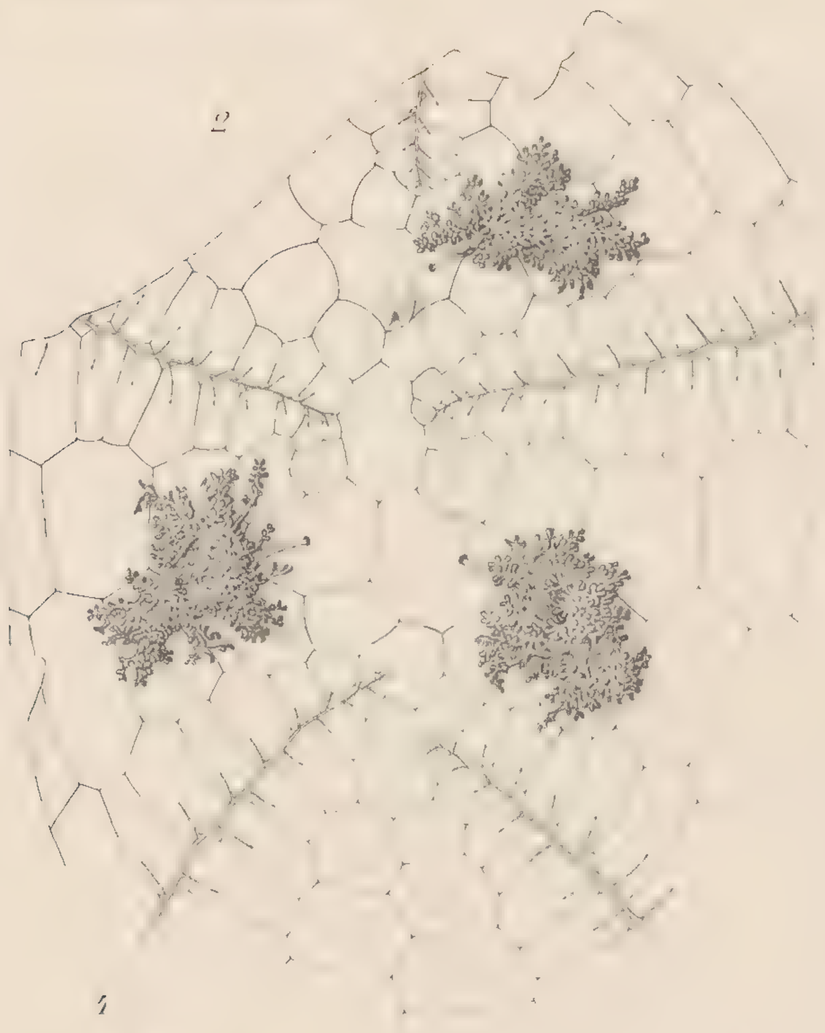
Plate 74.

1–5. **Urechinus giganteus** A. Ag.; Station 3431.

1. Abactinal system and adjoining plates of specimen 93 mm. in length.
2. The same, seen from the interior of the test.
3. Abactinal extremity of the odd ambulacrum, seen from the interior.
4. Abactinal extremity of same, somewhat more enlarged than fig. 3.
5. Twelfth abactinal interambulacral plate from the mouth, showing the resorption of some primary and miliary tubercles.

6–8. **Urechinus Naresianus** A. Ag.; "Blake" Exp., Station 222, off St. Lucia.

6. Actinal system and surrounding plates of specimen 13 mm. in diameter.
7. Abactinal system of same specimen.
8. Anal system and rudimentary anal fasciole of the same.



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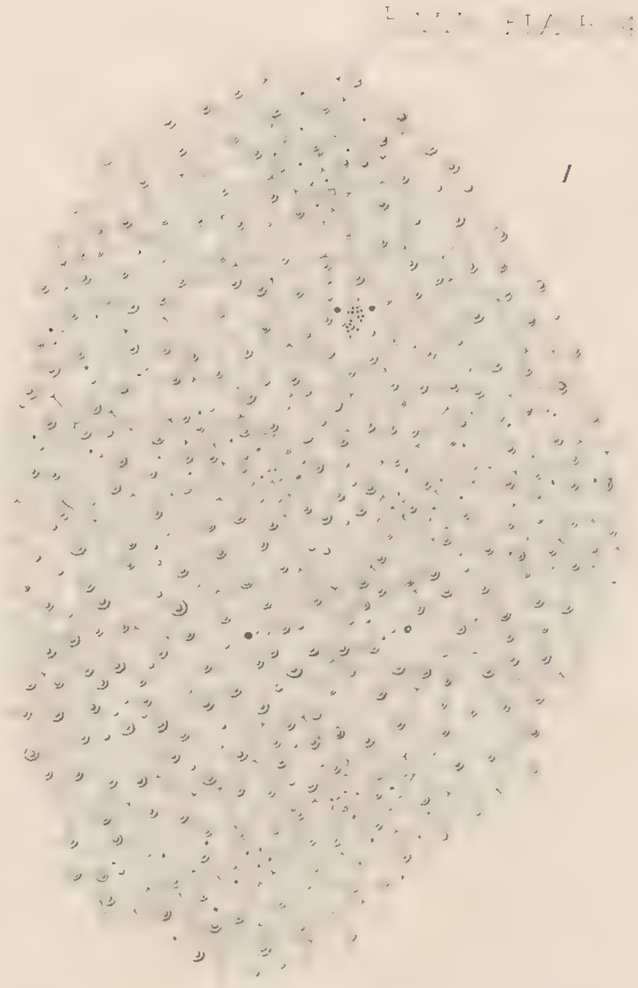

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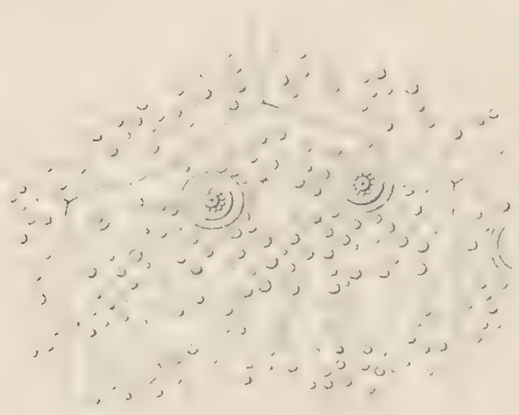
7



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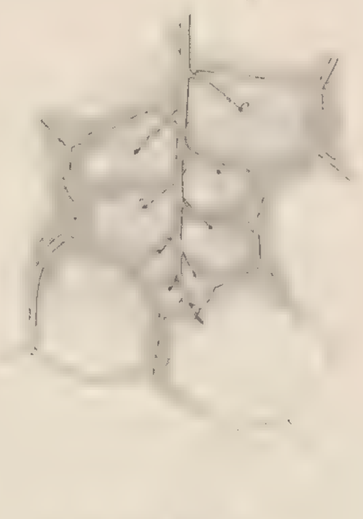

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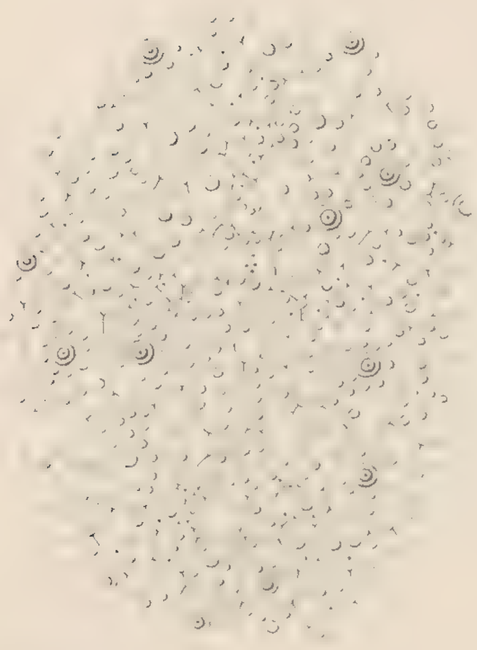
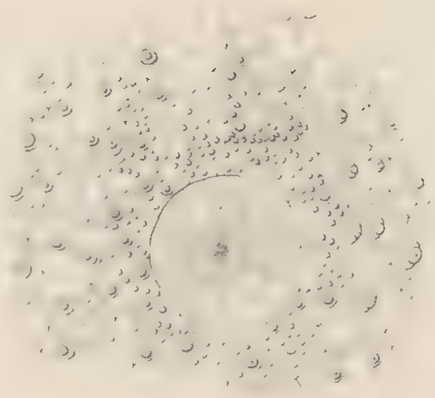




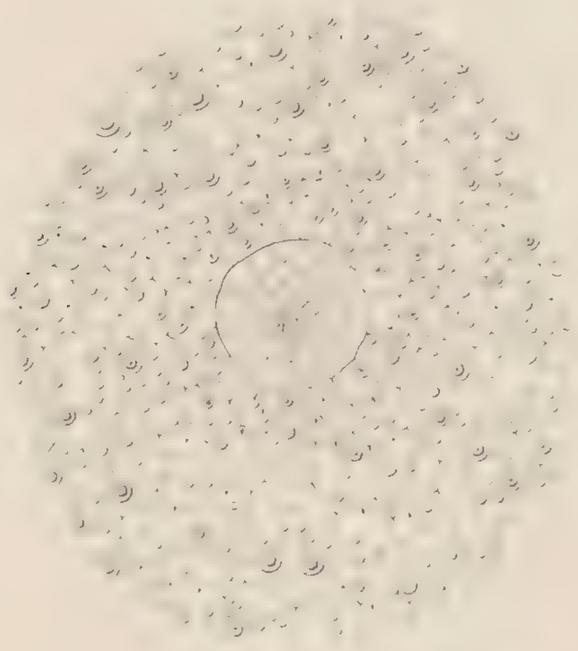


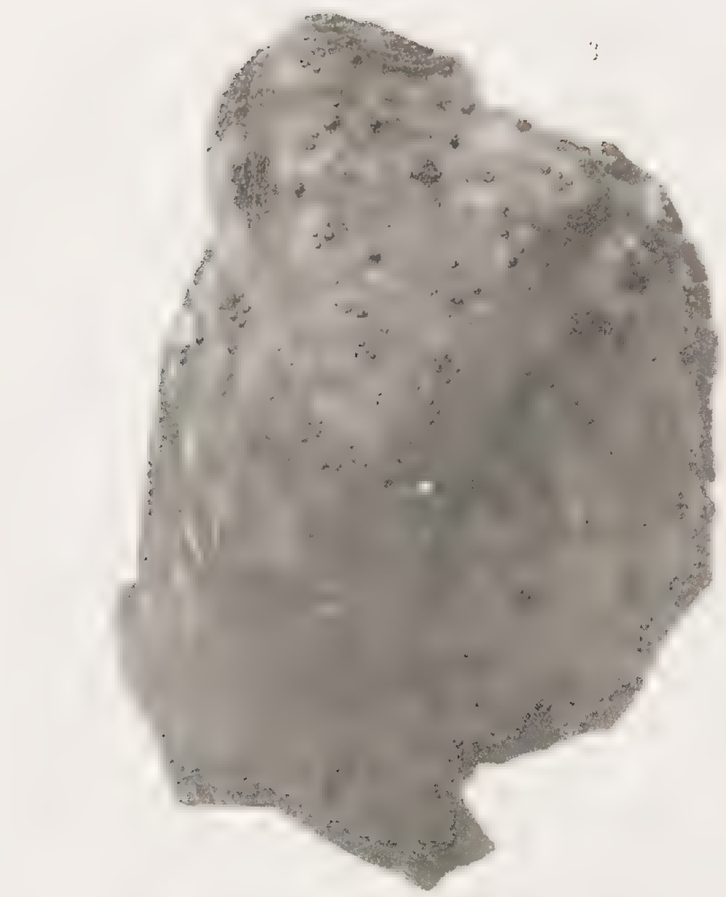
PLATE 75.

Plate 75.

1–4. Cystechinus Loveni A. Ag.; Station 3415.

1. Seen from the actinal side, 83 mm. in length.
2. Another specimen, 88 mm. in length, seen from the abactinal side, denuded.
3. Fragment showing the abactinal side.
4. The same fragment, seen from the interior.

All figures natural size.



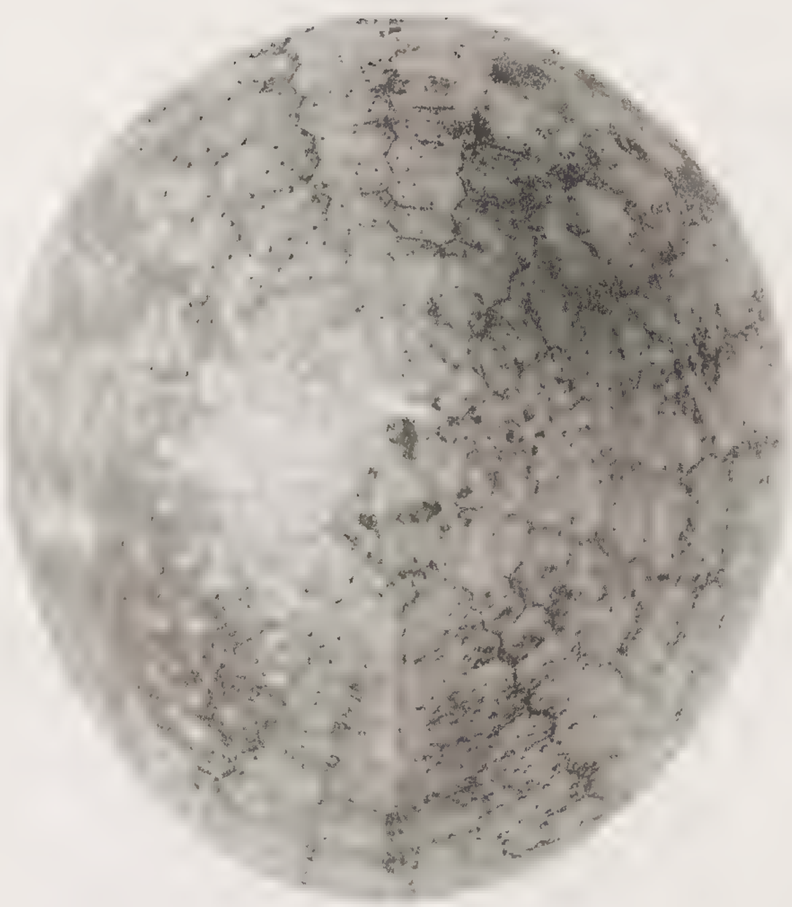


PLATE 76.

Plate 76.

1–5. **Cystechinus Loveni** A. Ag. ; Station 3415.

1. Specimen 88 mm. in length (Pl. 75, fig. 2), seen in profile, facing the right posterior interambulacrum.

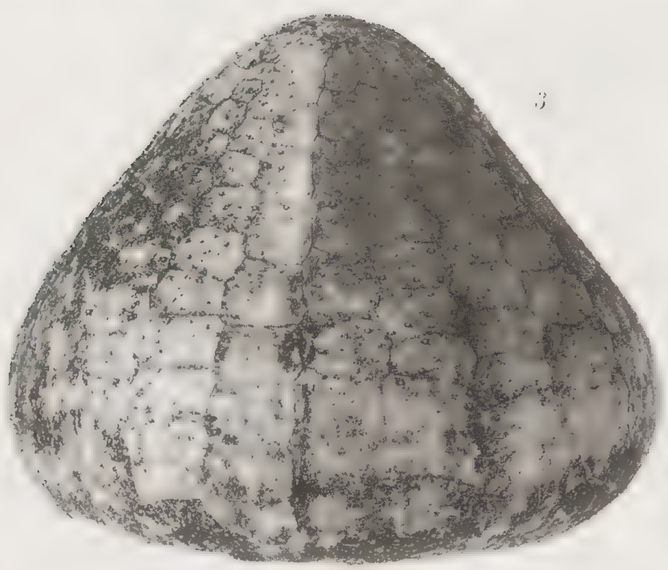
2. The same as fig. 1, seen from the anterior extremity, facing the odd ambulacrum.

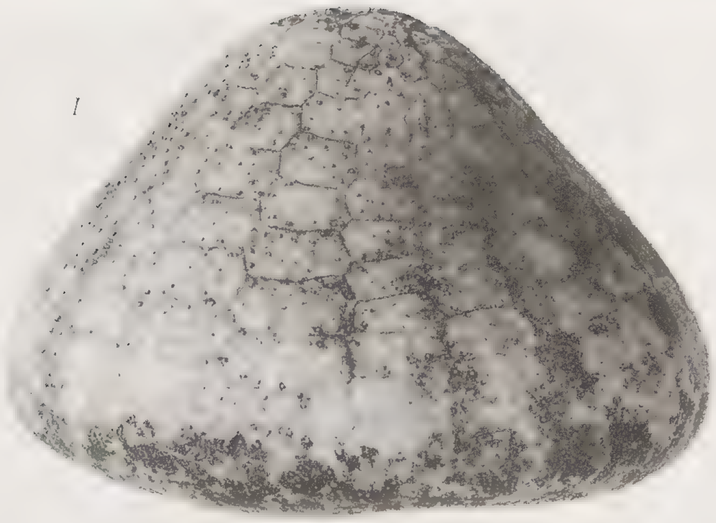
3. The same specimen, facing the odd interambulacrum.

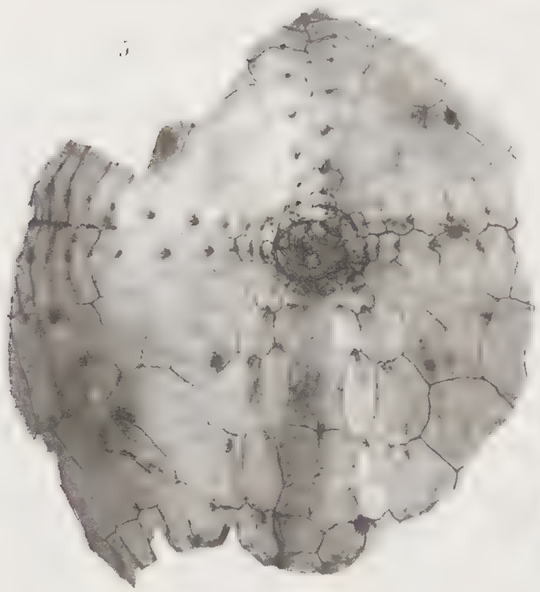
4. Fragment showing the actinostome and the surrounding plates, seen from the exterior.

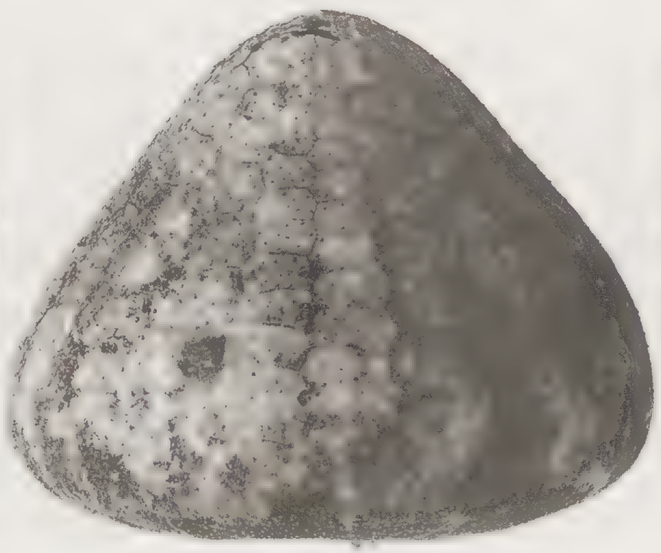
5. The same fragment, seen from the interior of the test.

All figures natural size.









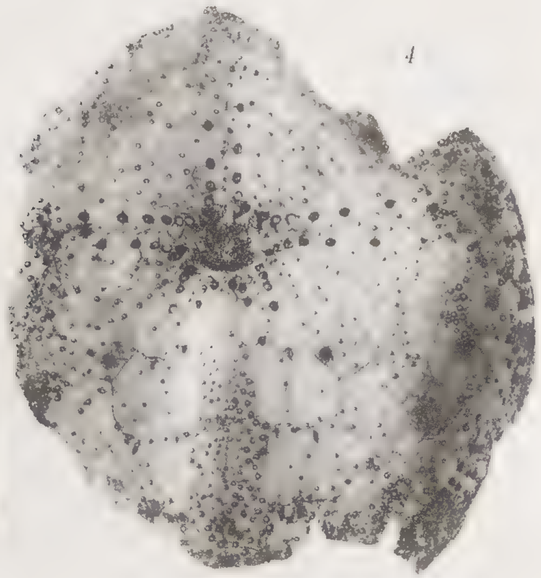


Plate 77.

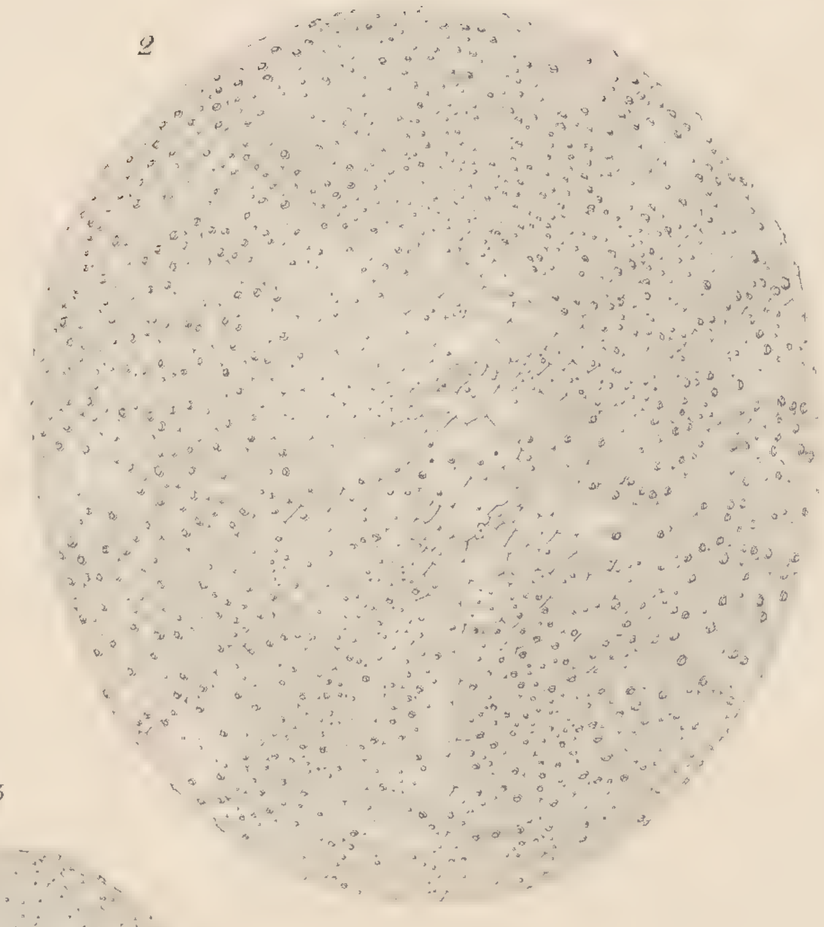
Plate 77.

1–4. Cystechinus Loveni A. Ag.; Station 3415.

1. Specimen 83 mm. in length, from the actinal side (Pl. 75, fig. 1).
2. Abactinal view of specimen 88 mm. in length (Pl. 75, fig. 2).
3. The same as fig. 2, seen in profile, facing the right anterior ambulacrum (Pl. 76, fig. 1).
4. Part of the right posterior interambulacrum at the ambitus, with the adjoining abactinal plates showing the sporadic resorption of the primary and miliary tubercles.

1

2



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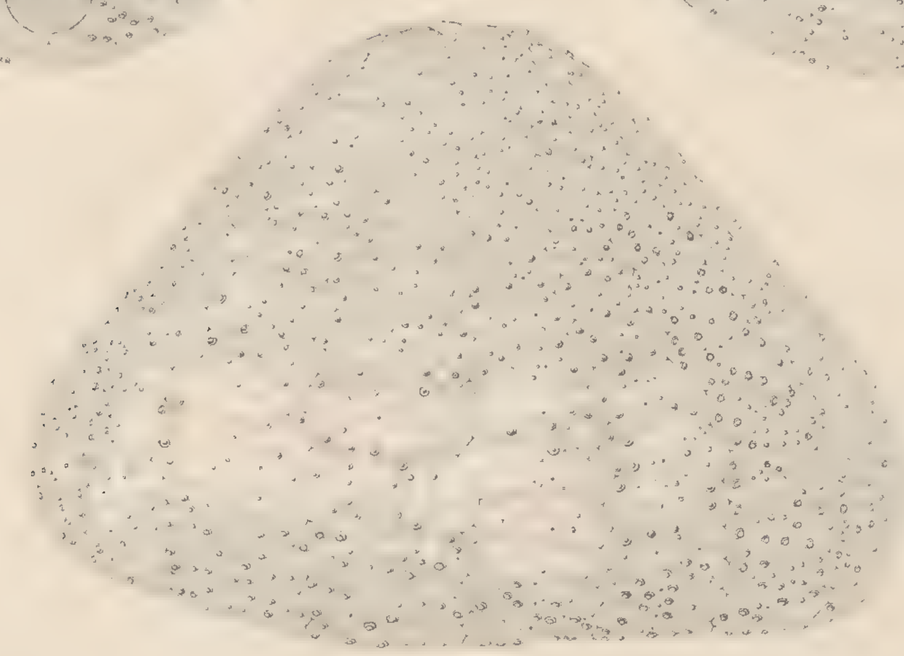

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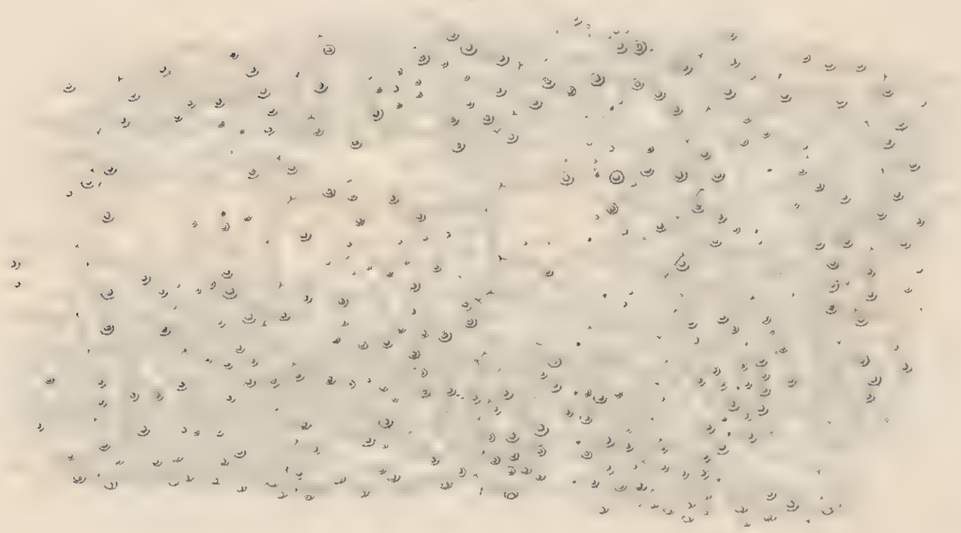
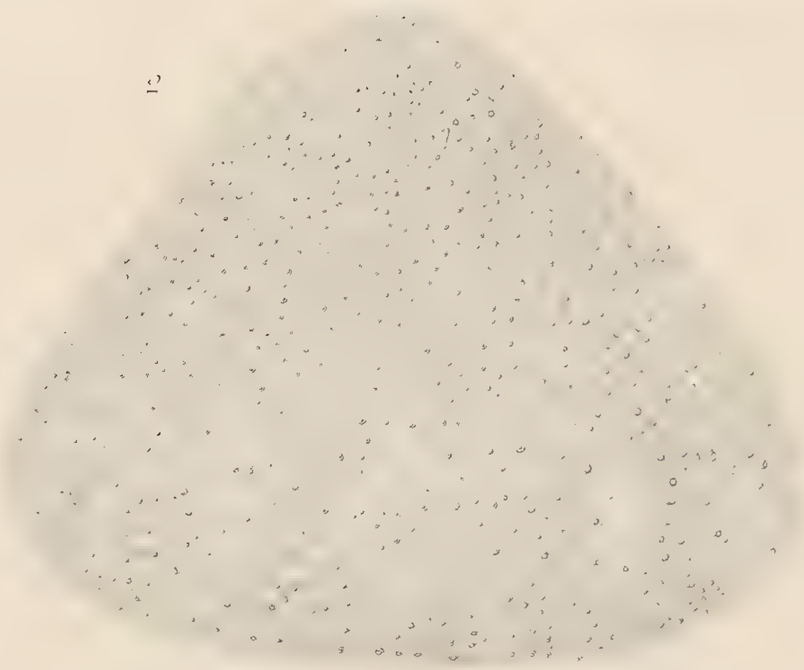


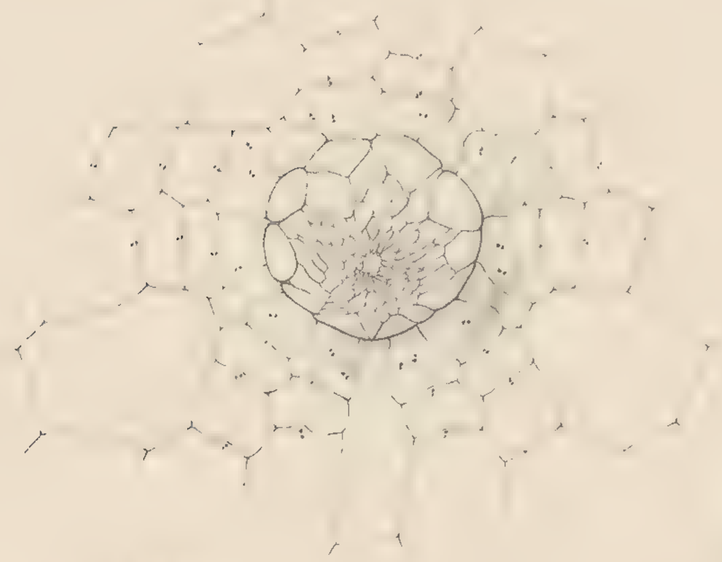
PLATE 78.

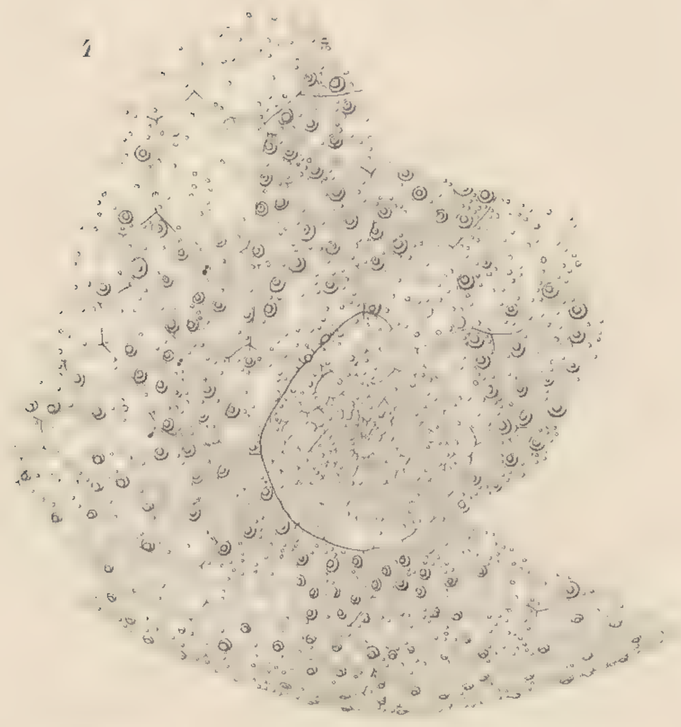
Plate 78.

1–6. **Cystechinus Loveni** A. Ag.; Station 3415.

1. Specimen 88 mm. in length, seen facing the odd interambulacrum (Pl. 76, fig. 3).
2. The same as fig. 1, seen facing the odd anterior ambulacrum (Pl. 76, fig. 2).
3. Actinostome and adjoining plates of specimen about 85 mm. in length (fragment).
4. Anal system of specimen about 88 mm. in length (fragment).
5. Actinal view from the interior of the same specimen as fig. 3.
6. Abactinal extremity of left anterior ambulacrum of same specimen as fig. 3, seen from the interior.







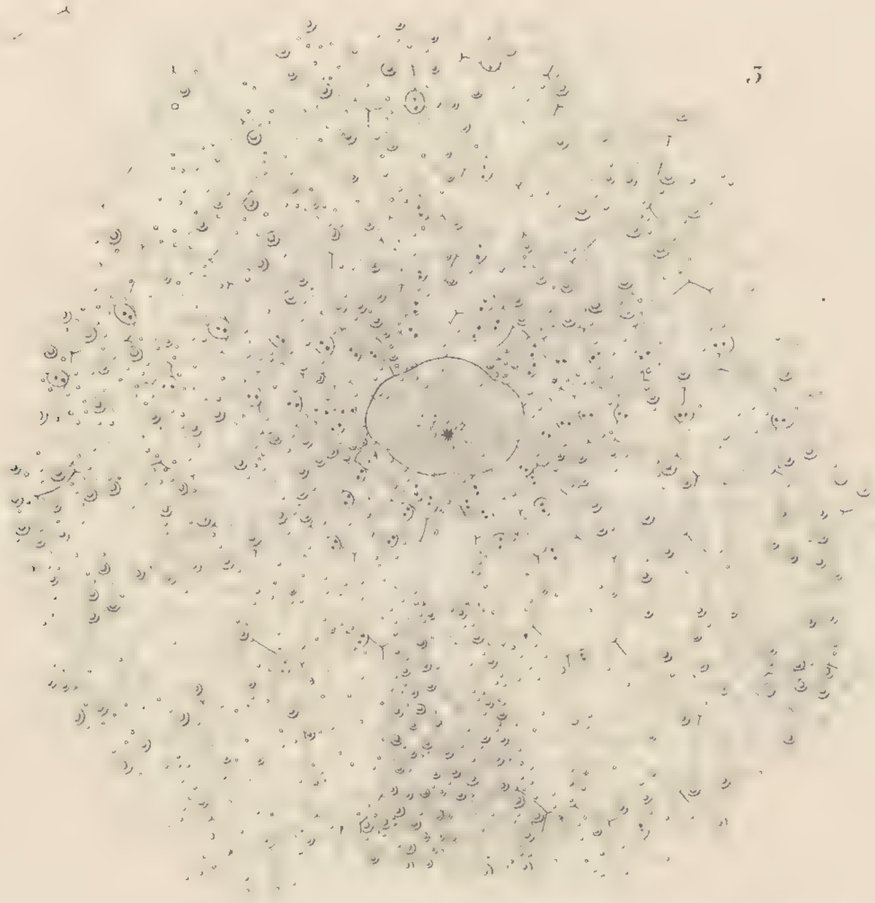


PLATE 79.

Plate 79.

1–4. **Cystechinus Loveni** A. Ag. ; Station 3415.

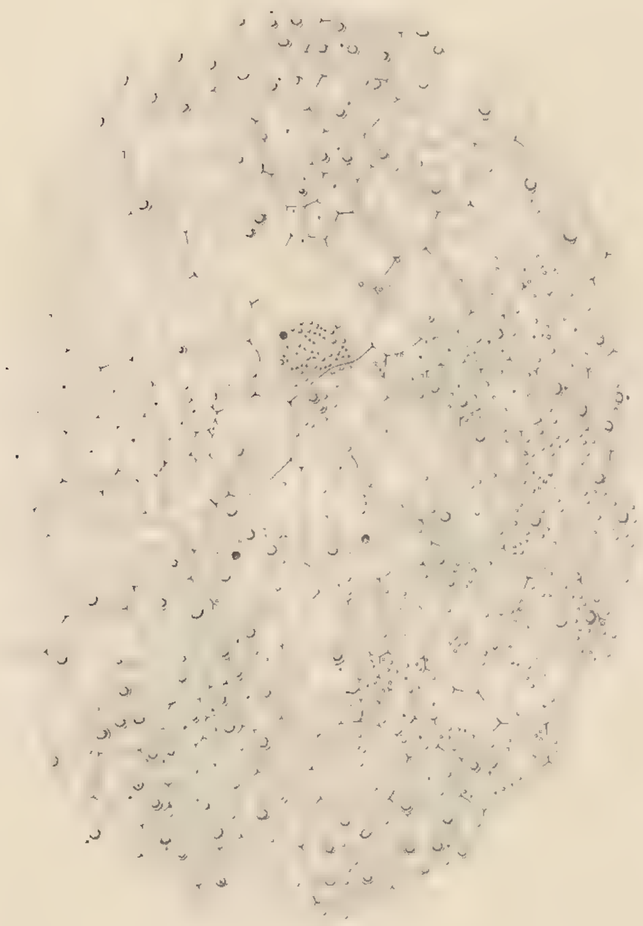
1. Abactinal system and adjoining plates of specimen 88 mm. in length (Pl. 75, fig. 2).

2. Fragment showing the abactinal system and adjoining plates of specimen about 85 mm. in length, seen from the interior.

3. Fragment of specimen about 80 mm. in length, showing the abactinal side of the test, seen from the interior.

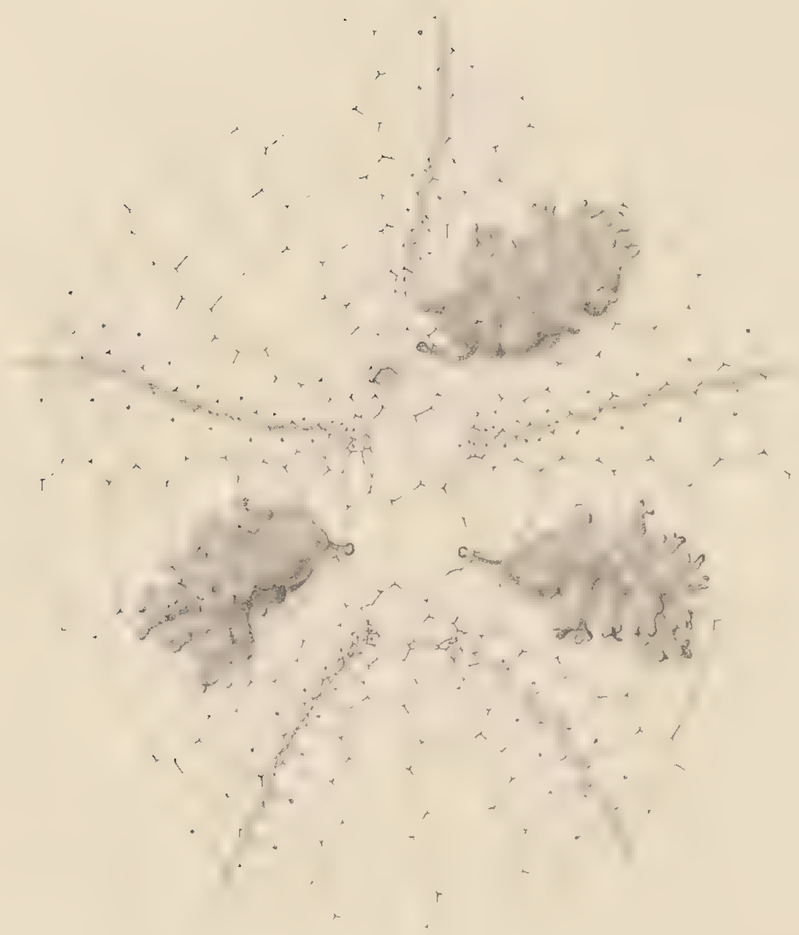
4. Fragment of specimen about 20 mm. in length, showing the abactinal system and adjoining plates.

1



2

3



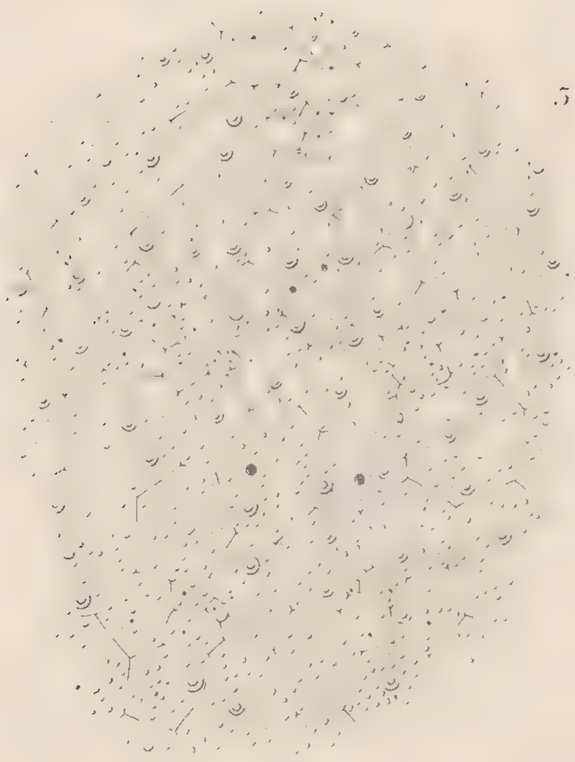
4

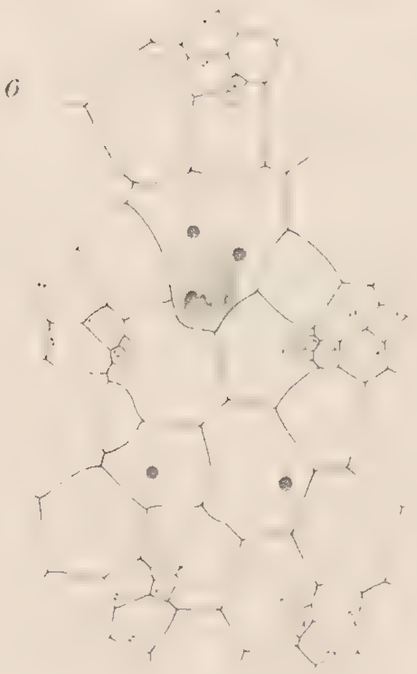
Plate 80.

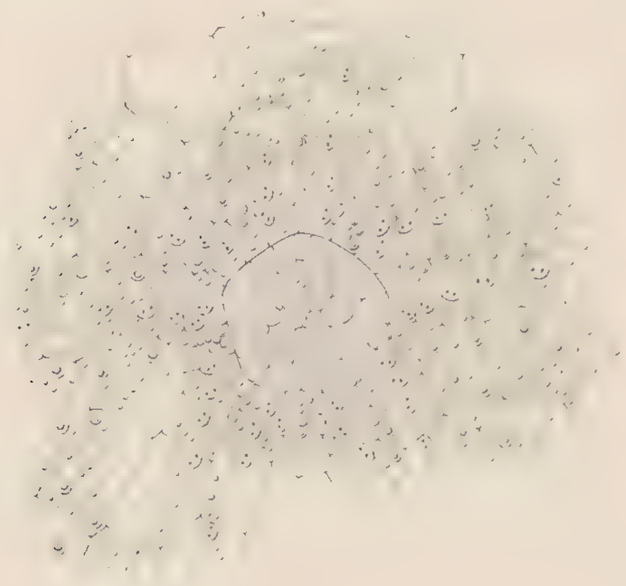
Plate 80.

1–7. Cystechinus Wyvillii A. Ag.

1. Specimen 18 mm. in length, seen from the actinal side; "Challenger" Station 146.
2. Actinal system and surrounding plates of specimen 56 mm. in diameter; "Challenger" Station 147.
3. Abactinal system and adjoining plates of same specimen as fig. 1.
4. Interior view of same as fig. 3.
5. Abactinal system and adjoining plates of same specimen as fig. 2.
6. Interior view of fig. 5.
7. Anal system of same specimen as fig. 2.







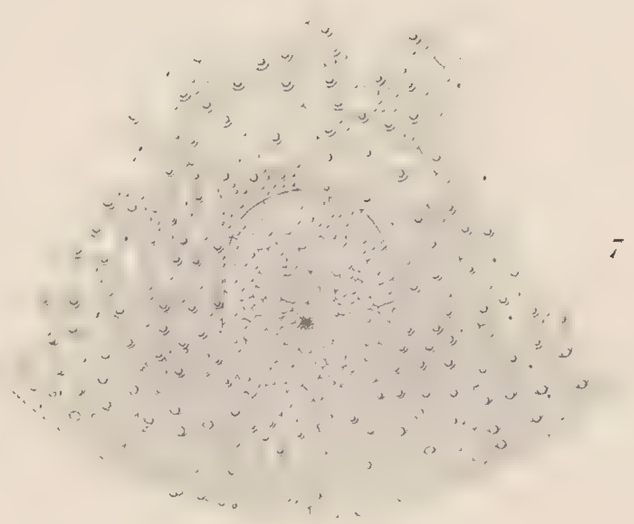


PLATE 81.

Plate 81.

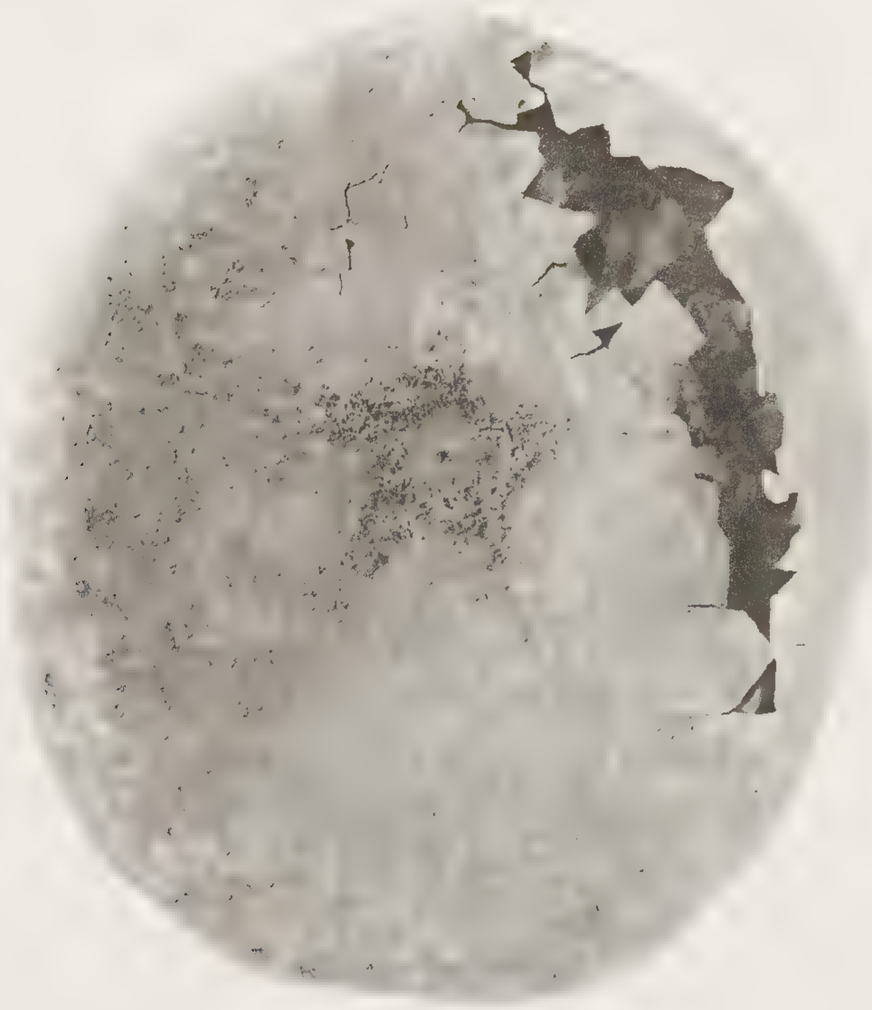
1, 2. Pilematechinus Rathbuni A. Ag.; Station 3374.

1. Specimen, seen from the actinal side.

2. The same specimen, seen from the abactinal side.

Both figures natural size.

1



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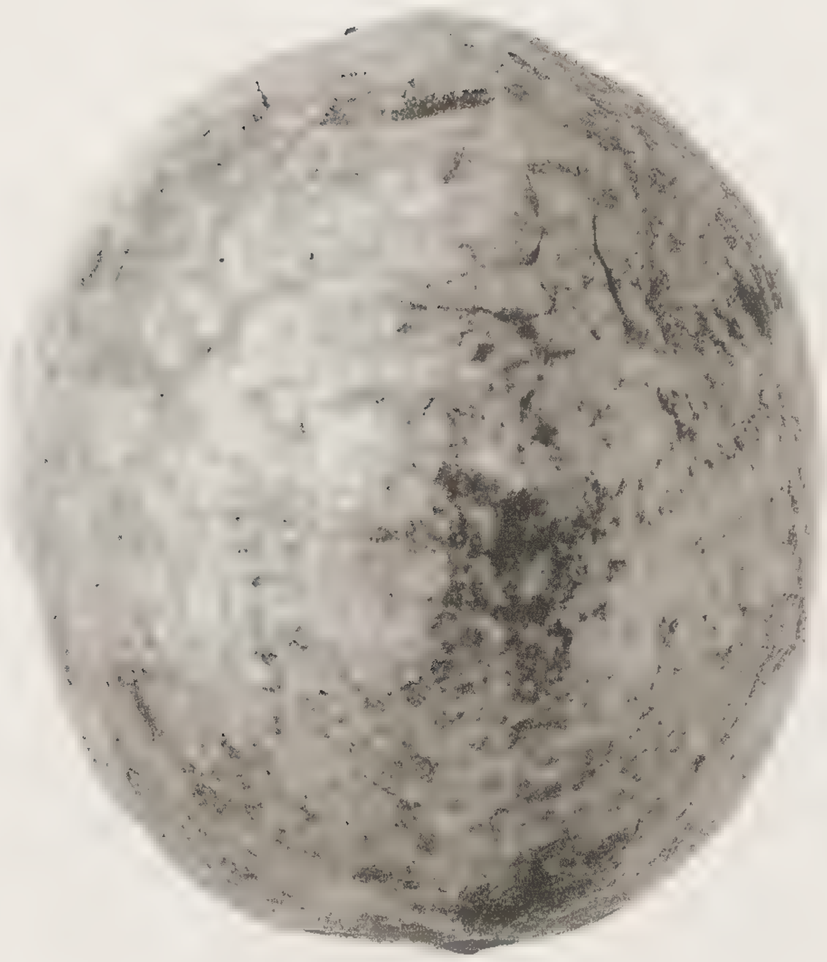


Heliotype [illegible]

PLATE 82.

Plate 82.

1, 2. **Pilematechinus Rathbuni** A. Ag.; Station 3374.

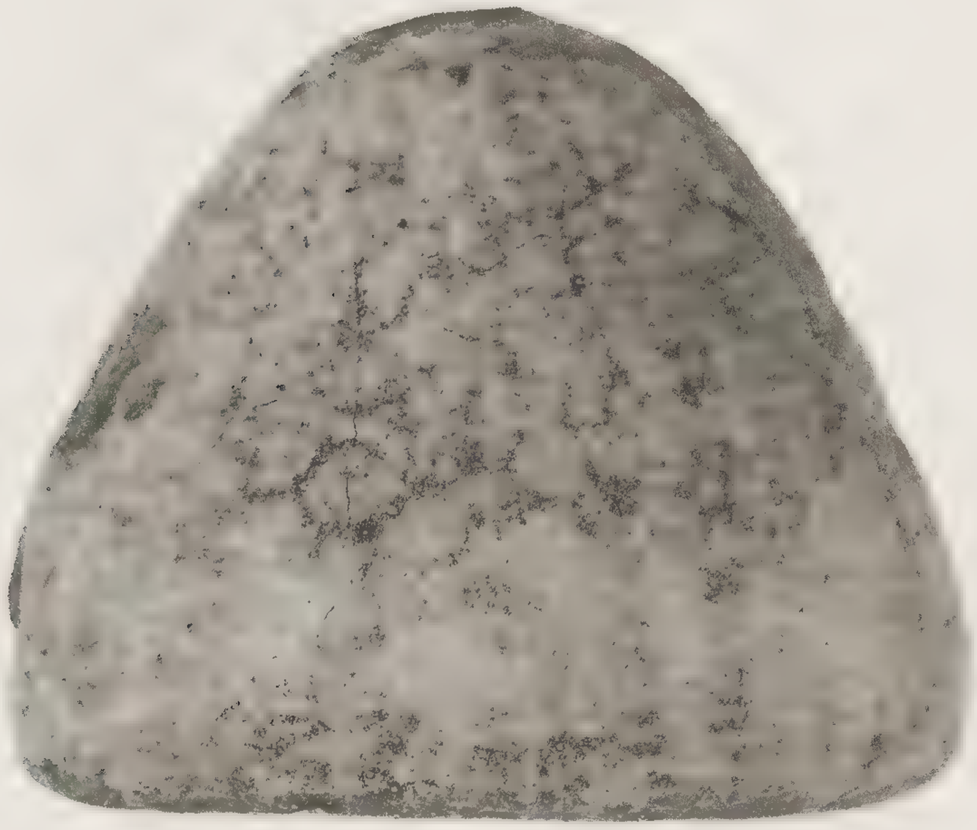
1. The specimen figured on Pl. 81, seen in profile, facing the right posterior ambulacrum.

2. The same, seen facing the anal system and odd posterior interambulacrum.

Both figures natural size.

2

1



Feb. type, 1 x 1.

PLATE 83.

Plate 83.

1, 2. **Pilematechinus Rathbuni** A. Ag.; Station 3374.

1. Specimen 92 mm. in length, denuded, seen from the actinal side (Pl. 81, fig. 1).

2. Specimen 92 mm. in length, denuded, seen from the abactinal side (Pl. 81, fig. 2).

Both figures natural size.

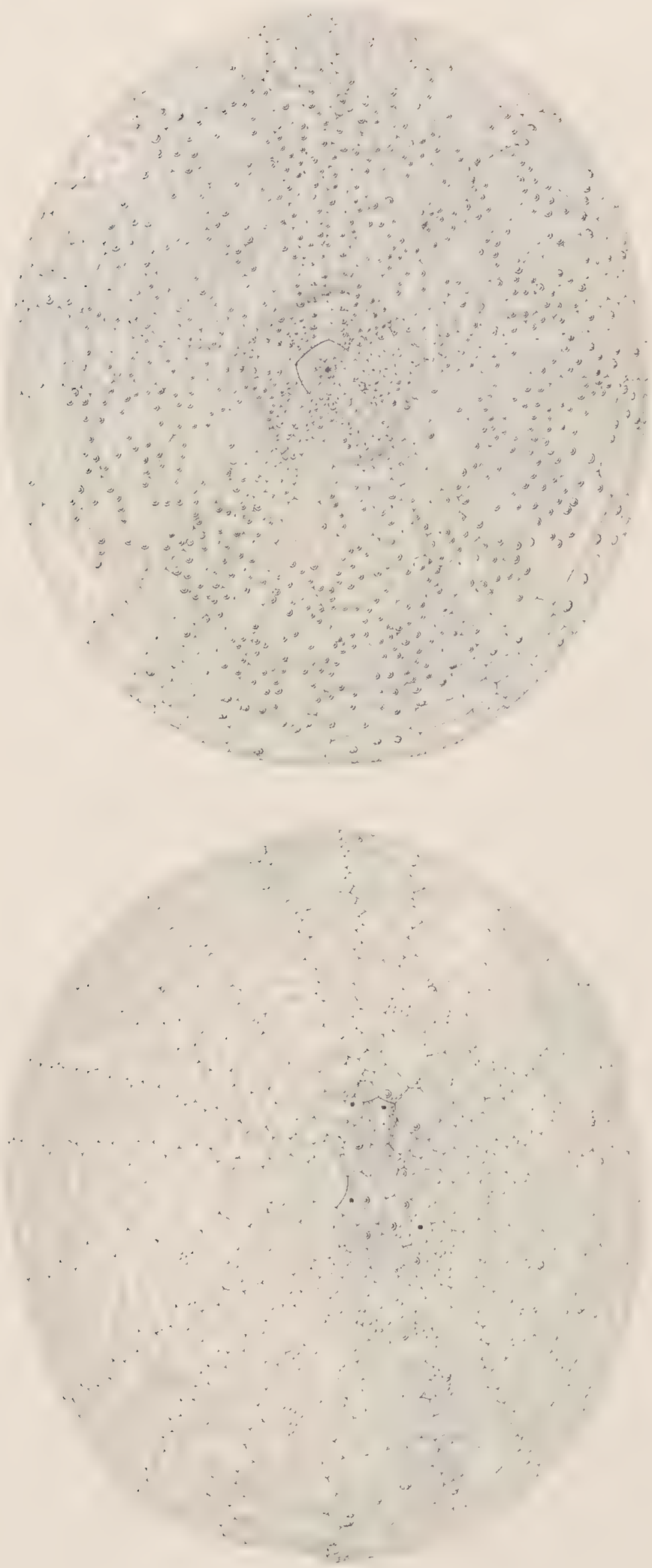


PLATE 84.

Plate 84.

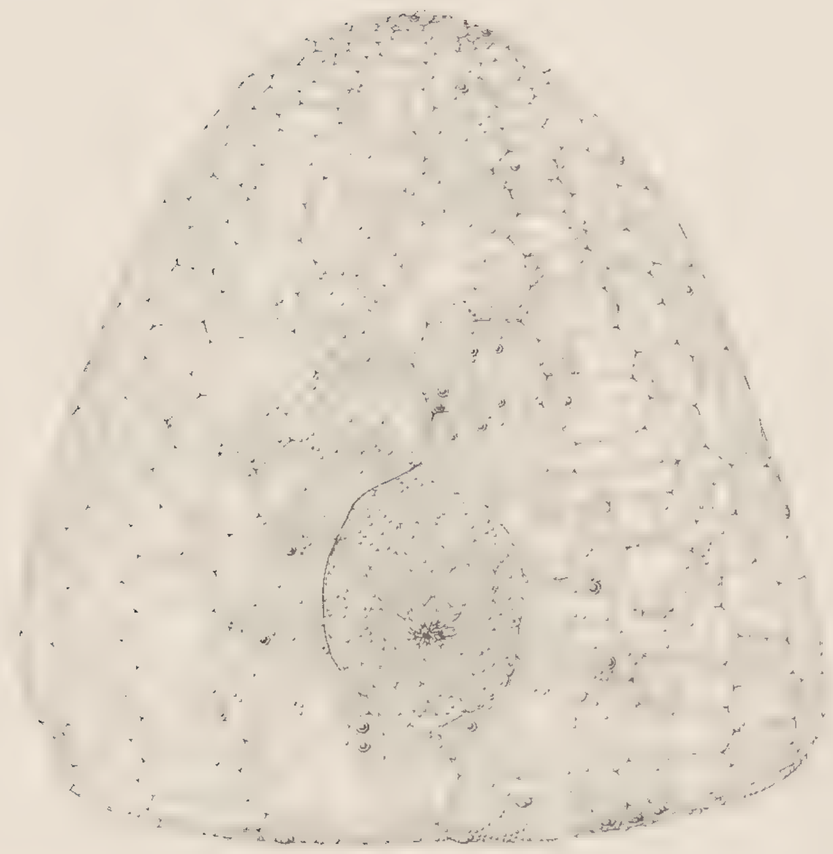
1, 2. **Pilematechinus Rathbuni** A. Ag.; Station 3374.

1. Same specimen as Pl. 83, fig. 2, seen facing the anal system and the odd posterior interambulacrum.

2. The same specimen, in profile, seen facing the right posterior interambulacrum (Pl. 82, fig. 1).

Both figures natural size.

1



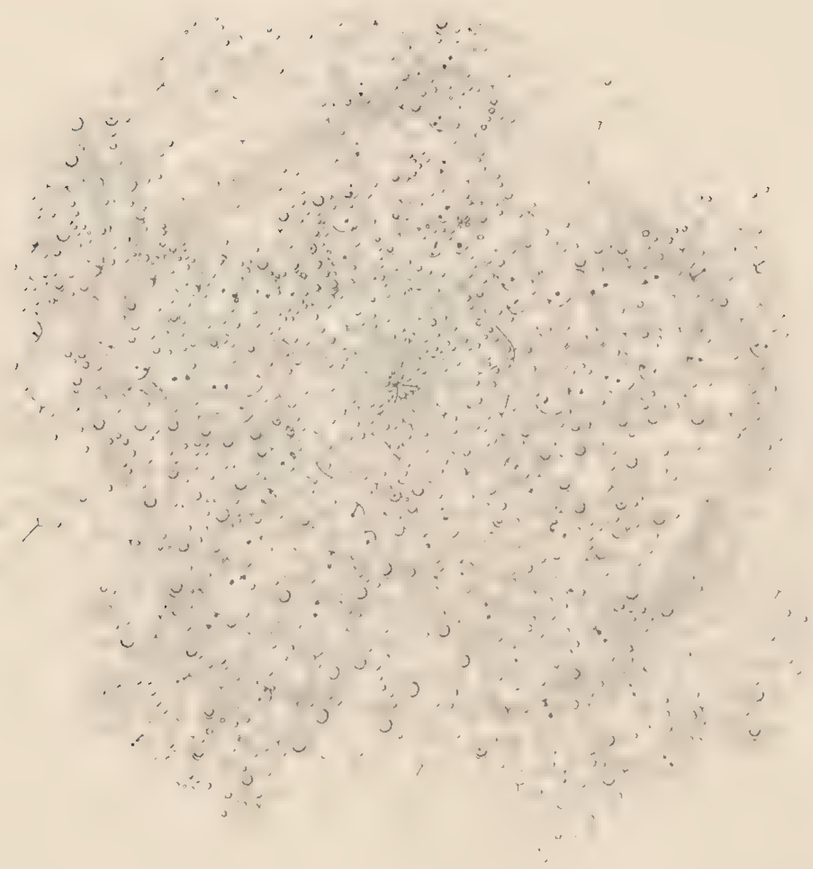
2

PLATE 85.

Plate 85.

1–5. **Pilematechinus Rathbuni** A. Ag.; Station 3374.

1. Actinostome and adjacent surrounding plates of a specimen 85 mm. in length.
2. Actinal system of same, seen from the interior of the test.
3. Abactinal system and surrounding plates of a specimen 95 mm. in length.
4. Abactinal system of same, seen from the interior.
5. One of the abactinal plates showing the splitting of a primary interambulacral plate, and the resorption of the primary and miliary tubercles; this is also shown in figs. 1 and 3.



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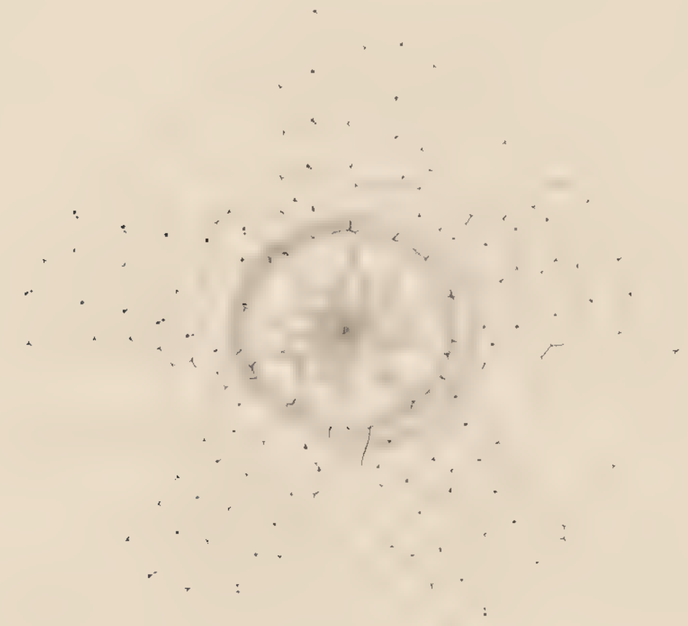

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Plate 86.

Plate 86.

1–5. Pilematechinus Rathbuni A. Ag.; Station 3374.

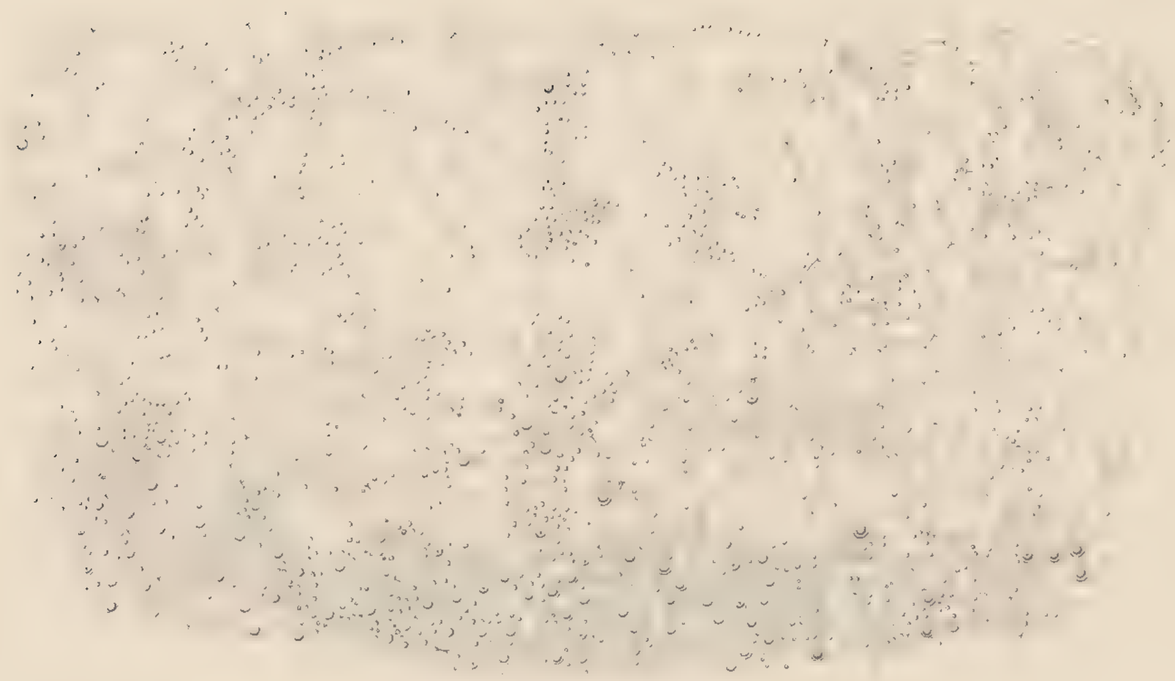
1. Part of ambitus and adjoining abactinal coronal plates to show the resorption of the primary tubercles in a specimen 95 mm. in length.

2. Part of fifth and sixth plates from the mouth, showing primary tubercles in different stages of resorption, from the right anterior ambulacrum.

3. Seventh plate from the mouth, showing partly and wholly resorbed tubercles in the region crowded with primary tubercles of the odd interambulacrum of a specimen 85 mm. in length.

4. One of the plates of the odd interambulacrum, seen from the interior, showing the splitting up of a primary plate of a specimen 85 mm. in length.

5. Anal system of a specimen 95 mm. in diameter.



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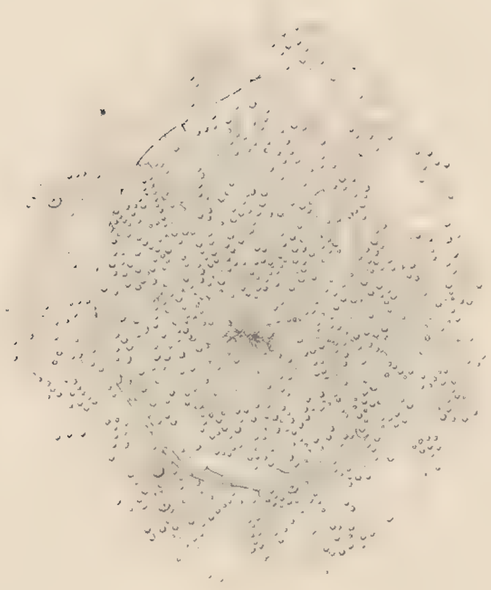

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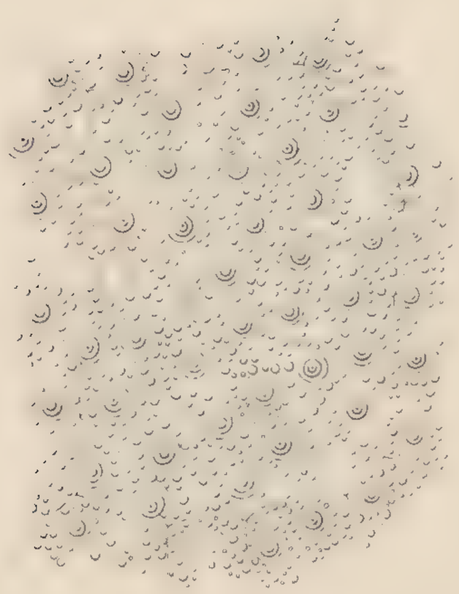

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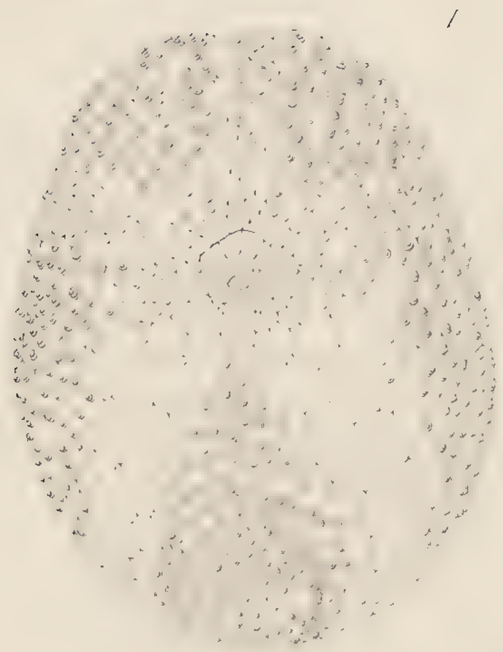
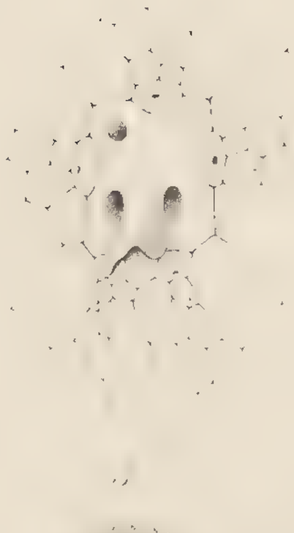
PLATE 87.

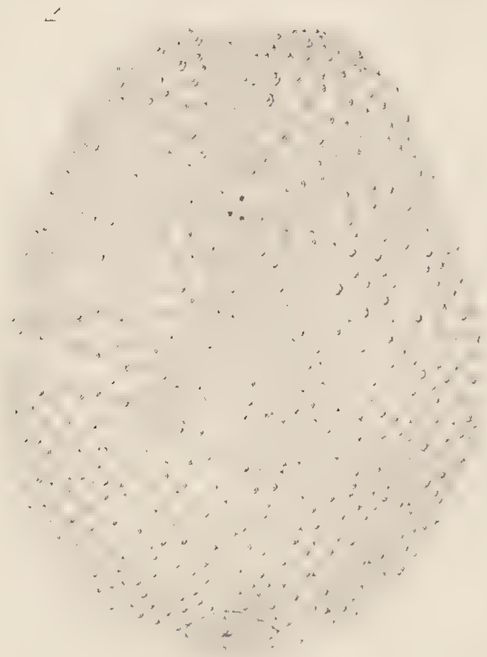
Plate 87.

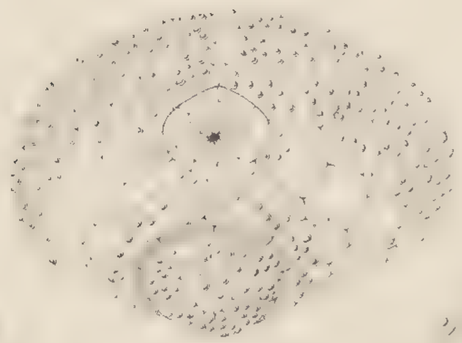
1–11. **Palæotropus Loveni** A. Ag.; "Challenger" Station 210.

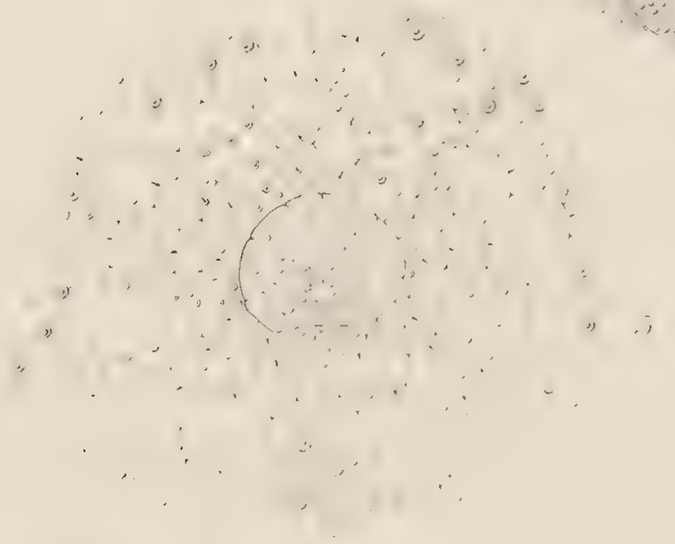
1. Specimen 23 mm. in length, seen from the actinal side.
2. The same, seen from the abactinal side.
3. The same, seen in profile, facing the left posterior interambulacrum.
4. The same, seen facing the anal system, sub-anal fasciole, and odd interambulacrum.
5. Actinostome and adjoining plates of a specimen 21 mm. in length.
6. Abactinal system and adjoining plates of same specimen as fig. 1.
7. Interior view of the same as fig. 6.
8. Actinostome of the same specimen as fig. 1.
9. Anal system of the same.
10. Actinostome of specimen 21 mm. in length.
11. Anal system of specimen 17 mm. in length.











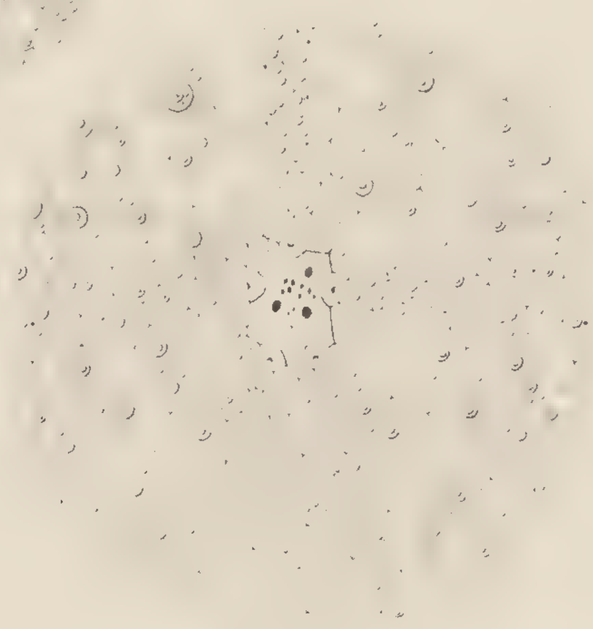


PLATE 88.

Plate 88.

1–5. **Phrissocystis aculeata** A. Ag.; Station 3366.

1. Fragments of specimen 120 mm. in length, seen from the abactinal side, showing parts of the left anterior interambulacrum and ambulacrum, and of the left posterior ambulacrum and odd interambulacrum with a few adjoining plates on either side.

2. Fragment of a somewhat larger specimen, showing the greater part of the ambital plates of the left anterior portion of the test, seen from the abactinal side.

3. Fragment showing a few plates of the odd anterior ambulacrum near the ambitus, seen from the interior.

4. Fragment showing the actinostome, seen from the actinal side.

5. Fragment showing the anal extremity in profile; 3–5 are fragments of a specimen about 120 mm. in length.

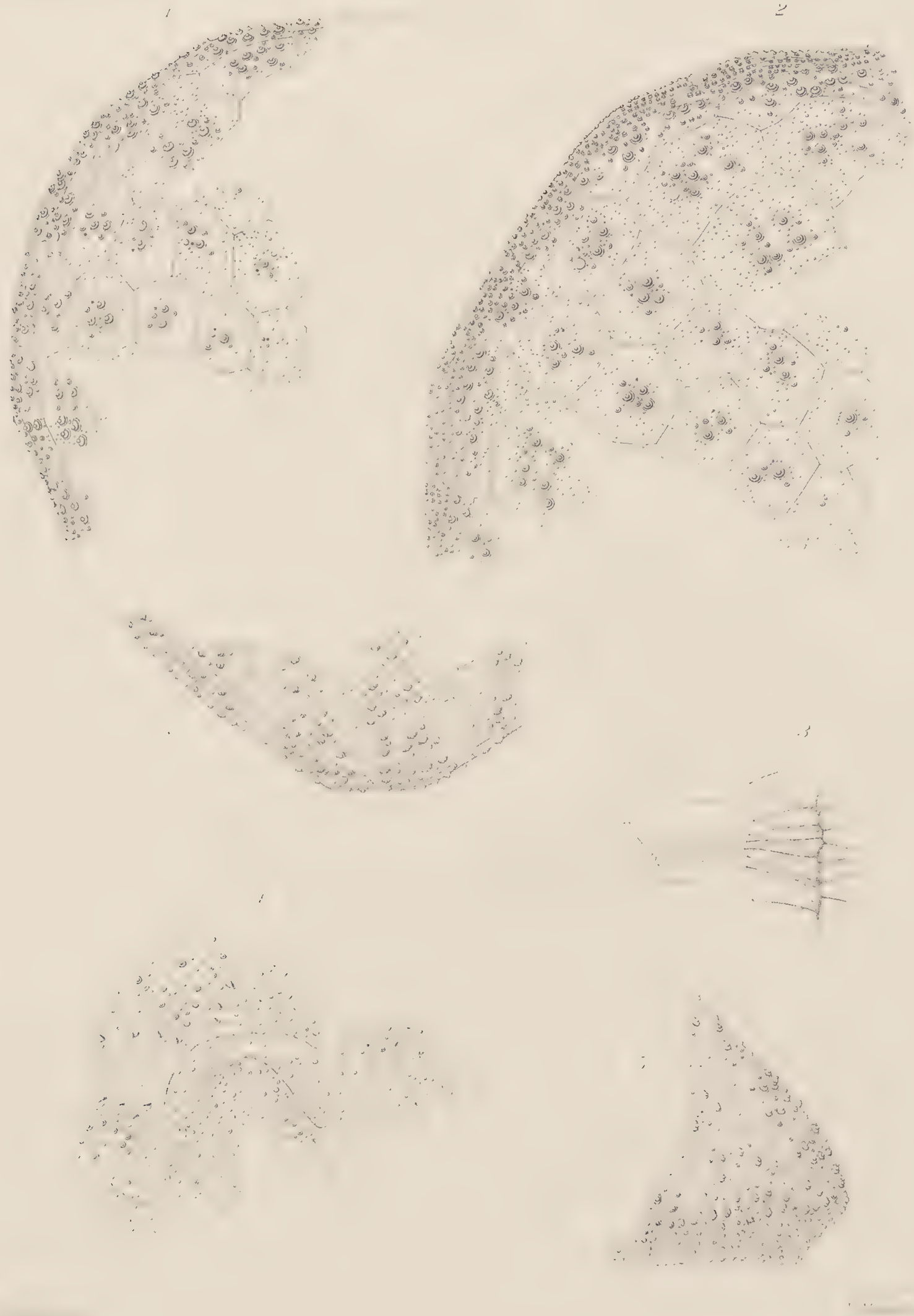


PLATE 89.

Plate 89.

1–4. **Phrissocystis aculeata** A. Ag.; Station 3366.

1. Fragment showing the abactinal system and the surrounding plates of the abactinal side.

2. Fragment of a specimen, showing the odd and the left anterior ambulacra, with the intervening and adjoining plates, seen from the abactinal side. The fragments of figs. 1, 2, belong to a specimen fully as large as the one figured in Pl. 88, fig. 2.

3. Fragment of a smaller specimen, showing the abactinal system somewhat more enlarged than fig. 1.

4. The same, seen from the interior.

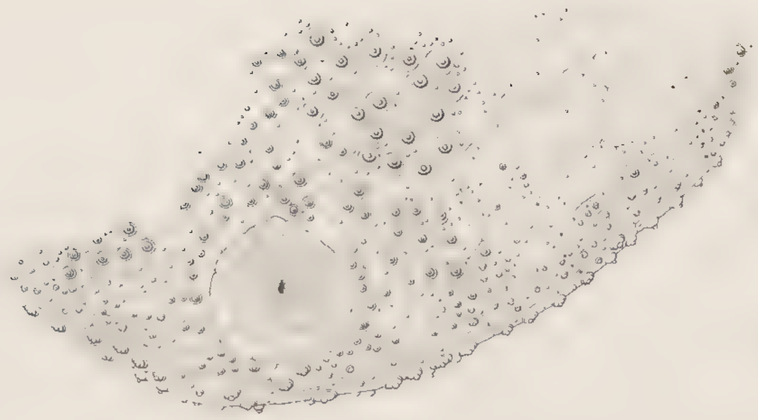
PLATE 90.

Plate 90.

1–4. Phrissocystis aculeata A. Ag.; Station 3366.

1. Fragment showing the odd posterior interambulacrum and adjoining plates.
2. The left posterior ambulacrum and adjoining plates (fragment).
3. Fragment showing the anal system with surrounding plates and part of the left posterior ambulacrum.
4. Fragment showing part of the odd posterior interambulacrum and adjoining plates near the ambitus on the abactinal side.

3



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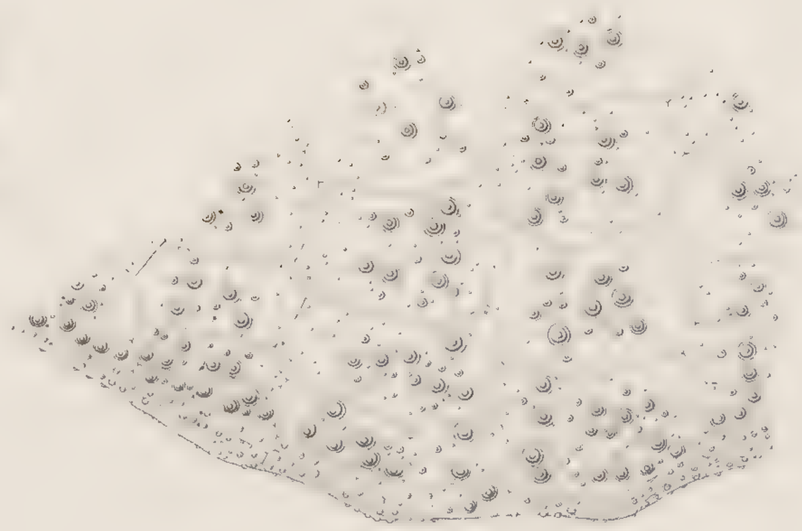

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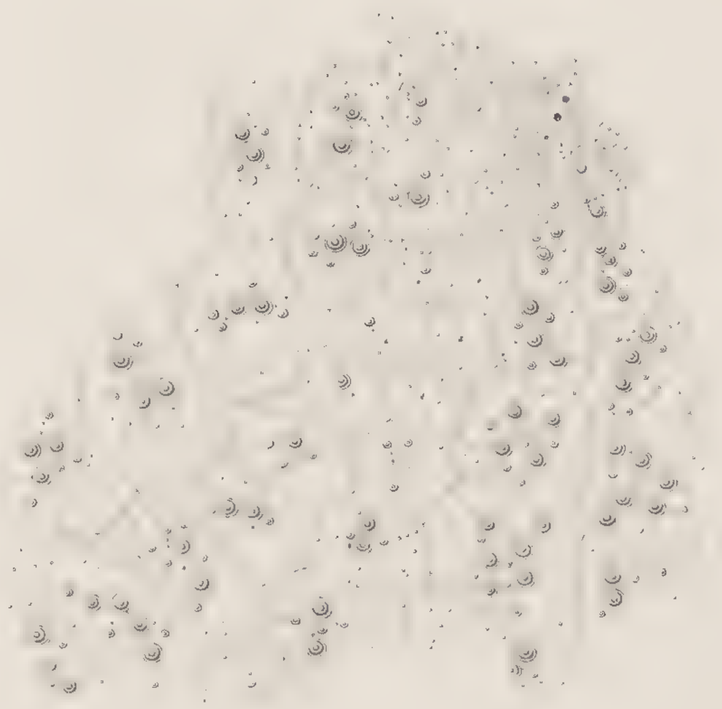


PLATE 91.

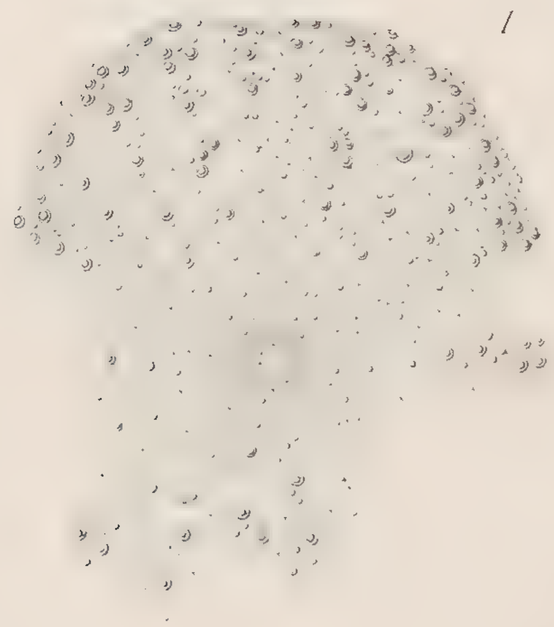
Plate 91.

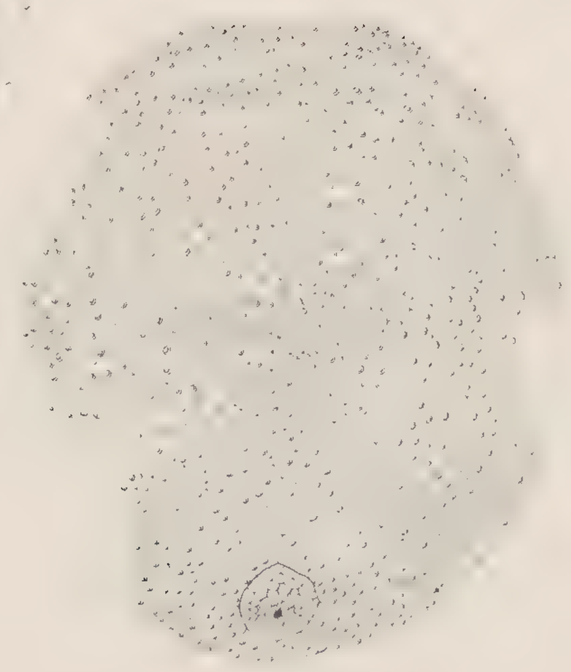
1–3. **Argopatagus vitreus** A. Ag.; "Challenger" Station 191.

1. Abactinal side of fragment about 48 mm. in length.
2. Actinostome and surrounding plates of same fragment.
3. Abactinal system of same fragment as fig. 1.

4–7. **Genicopatagus affinis** A. Ag.; "Challenger" Station 157.

4. Actinal side of fragment 37 mm. in length.
5. Same as fig. 4, seen from the abactinal side.
6. Abactinal system of fig. 5.
7. Anal system of same.





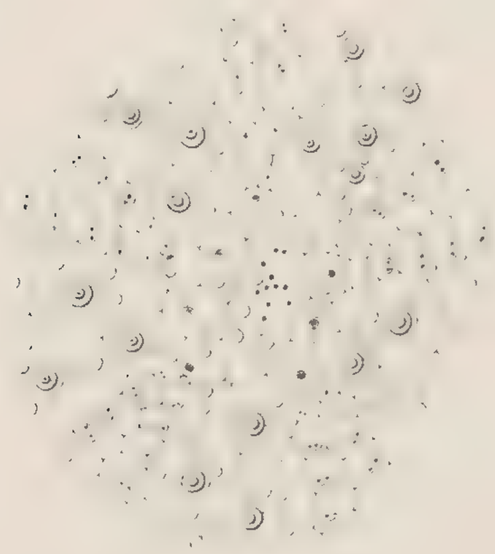


PLATE 92.

Plate 92.

1–2. **Linopneustes longispinus** A. Ag.; "Blake," 1878–79, Station 148, off St. Kitts 208 fms.

1. Denuded specimen, 82 mm. in length, seen from the actinal side.

2. The same view of a larger specimen, 110 mm. in length.

1

PLATE 93.

Plate 93.

1–3. Linopneustes longispinus A. Ag.; "Blake," 1878–79, Station 148, off St. Kitts 208 fms.

1. The same specimen as Pl. 92, fig. 2; 110 mm. in length, seen from the abactinal side.

2. Primary and miliary tubercles from the second plate from the actinostome of the left anterior interambulacrum.

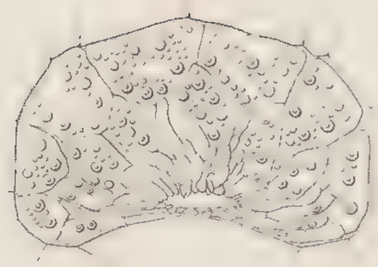
3. Primary tubercles and miliaries from the tenth plate from the actinostome of the left anterior interambulacrum, abactinal side.

PLATE 94.

Plate 94.

1–7. **Linopneustes longispinus** A. Ag.; "Blake," 1878–79, Station 148, off St. Kitts 208 fms.

1. Showing the ambitus of specimen 110 mm. in length (Pl. 92, fig. 2), facing the left posterior interambulacrum.
2. Actinostome of same specimen.
3. Actinostome of specimen 82 mm. in length (Pl. 92, fig. 1).
4. Anal system of specimen 110 mm. in length (Pl. 92, fig. 2).
5. Anal system of specimen 82 mm. in length (Pl. 92, fig. 1).
6. Tenth plate from the actinostome of the left posterior interambulacrum with adjoining plates of the left anterior ambulacrum.
7. Abactinal system of specimen 110 mm. in length (Plate 93, fig. 1).



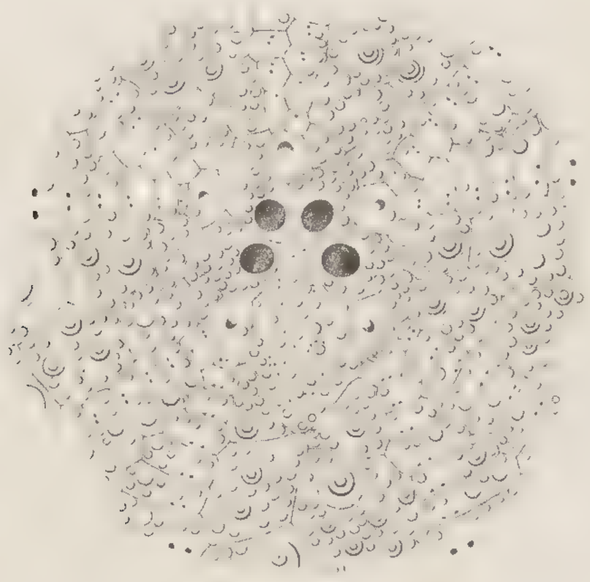


Plate 95.

Paleopneustes cristatus A. Ag.; "Blake," 1877–78, off Havana 200 fms.
Actinal view of specimen 140 mm. in length.

PLATE 96.

Plate 96.

1–5. Paleopneustes cristatus A. Ag.

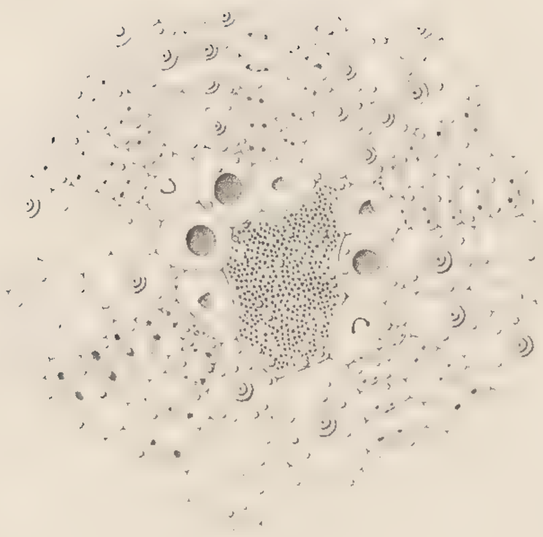
1. Actinostome and surrounding plates of specimen measuring 140 mm. in length; "Blake," 1878–79, Station 132, off St. Cruz 115 fms.

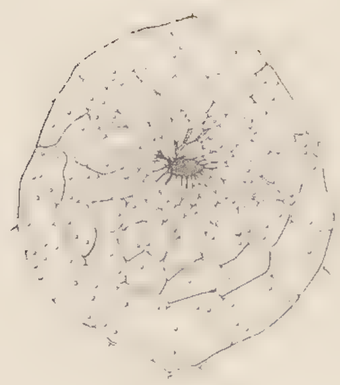
2. Same as fig. 1, seen from the interior of the test.

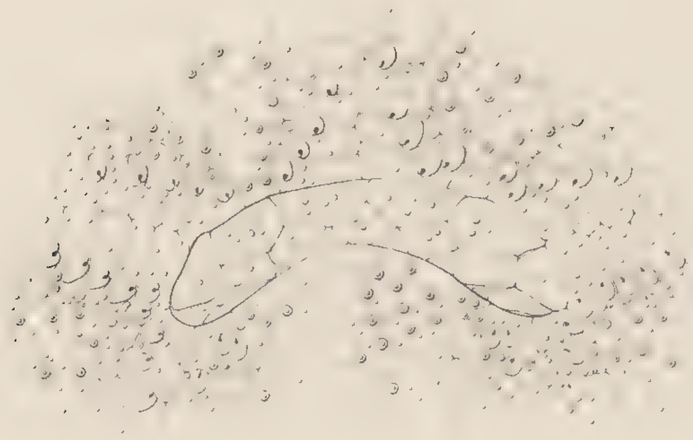
3. Abactinal system and surrounding plates of specimen about 140 mm.; "Blake," 1877–78, off Havana 200 fms.

4. Anal system of same.

5. Primary tubercles with more or less imperfect scrobicular rings.







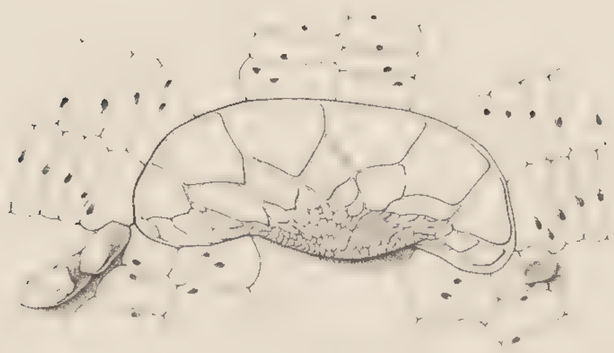


PLATE 97.

Plate 97.

1–5. Paleopneustes hystrix A. Ag.; "Blake," 1878–79, Station 157, off Montserrat 120 fms.

1. Denuded specimen, 135 mm. in length, seen from the actinal side.
2. Abactinal system of same.
3. Anal system of same.
4. Primary interambulacral spine of the actinal side.
5. Primary interambulacral spine of the abactinal side.

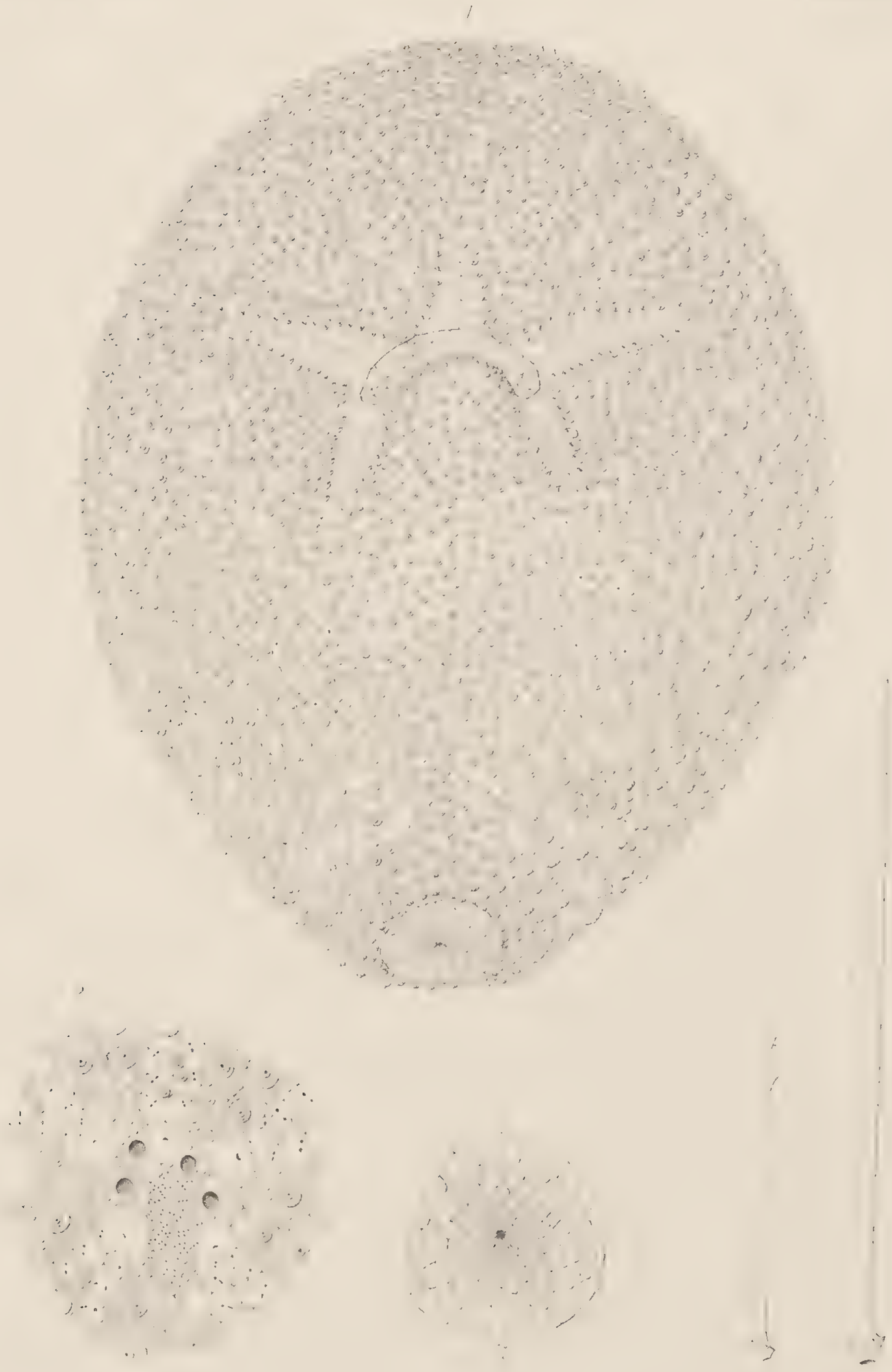


PLATE 98.

Plate 98.

1–11. **Nacopatagus gracilis** A. Ag.; "Hassler" Exp., off Juan Fernandez 65 fms.

1. Young specimen of 6.5 mm., seen from the actinal side.
2. Specimen 17 mm. in length, seen from the actinal side.
3. The same as fig. 2, seen from the abactinal side.
4. The same as fig. 2, seen in profile facing the left posterior interambulacrum.
5. Abactinal system and surrounding plates of specimen of 6.5 mm., seen from the exterior.
6. Abactinal system and surrounding plates of specimen 17 mm. in length, seen from the interior.
7. Actinostome of specimen 11.5 mm. in length.
8. The second plate of the posterior zone of the left posterior ambulacrum of specimen, 6.5 mm. in length.
9. The same plate of a specimen 9 mm. in length.
10. The same plate of a specimen 11 mm. in length.
11. The same plate of the specimen of fig. 2, 17 mm. in length.

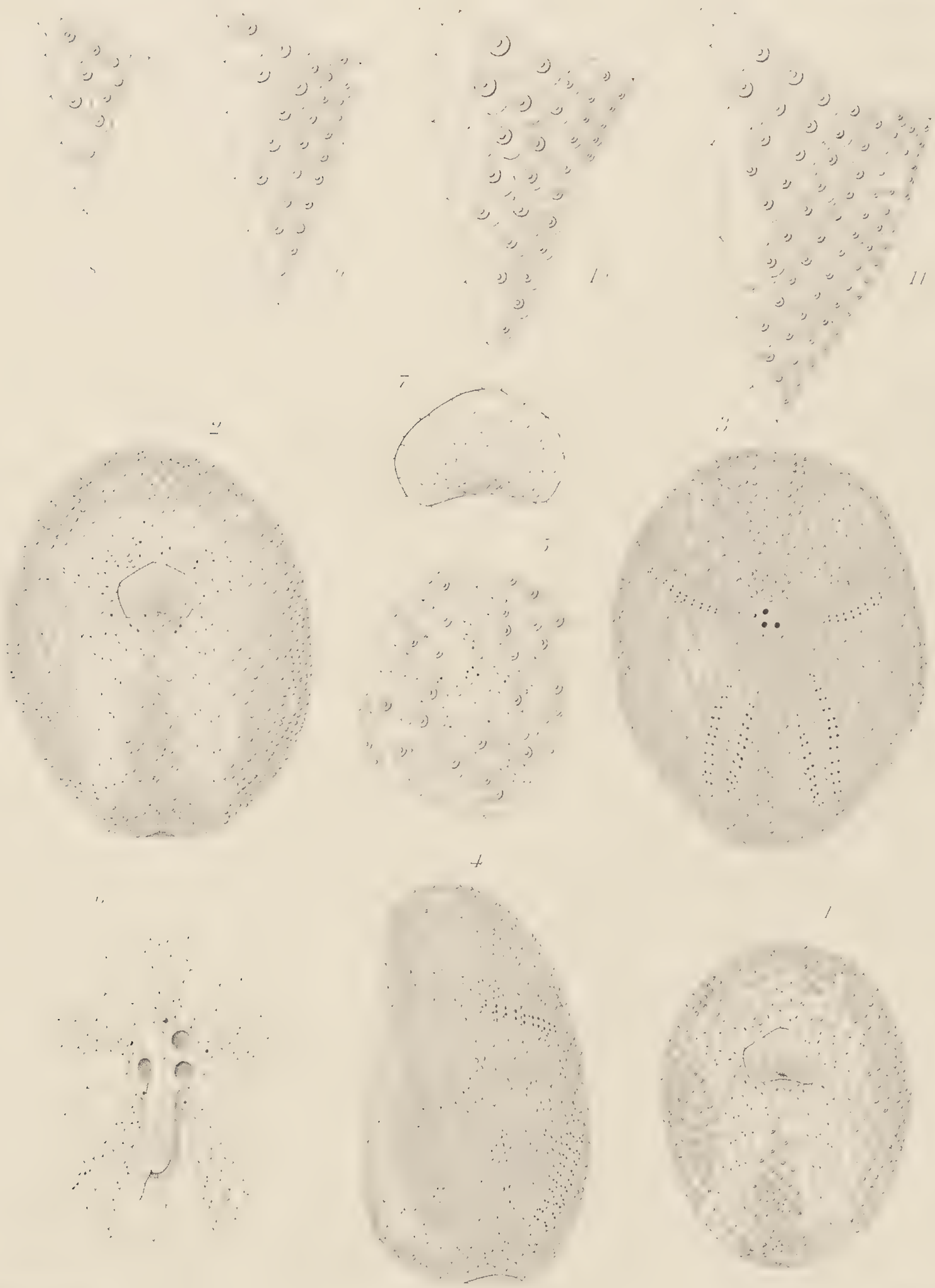


PLATE 99.

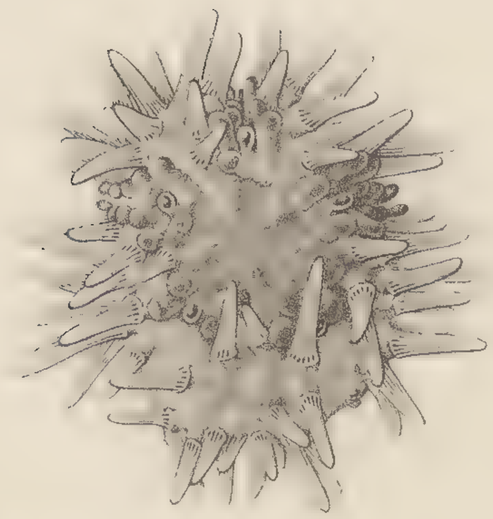
Plate 99.

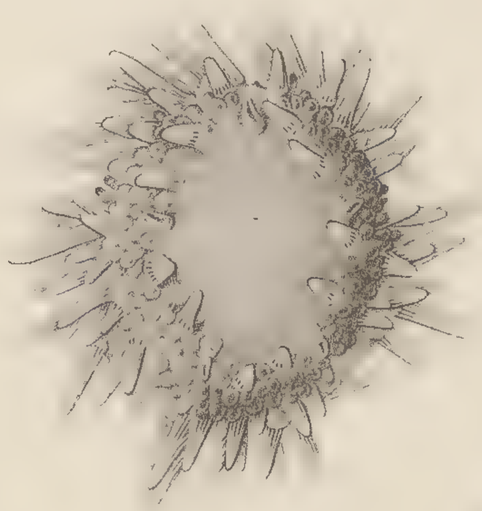
1–10. Abatus cavernosus Trosch.[1]

U. S. "Transit of Venus" Exp., 1874–75, Kerguelen Islds., Dr. J. H. Kidder, U. S. N., National Museum.

1. Young specimen with spines 1.6 mm. in length, taken from the breeding pouch, seen from the actinal side.
2. The same as fig. 1, seen from the abactinal side.
3. The same as fig. 1, denuded, seen from the actinal side.
4. The same as fig. 2, denuded, seen from the abactinal side.
5. The same as figs. 3, 4, seen facing the odd posterior interambulacrum.
6. The abactinal system of fig. 4, magnified.
7. The abactinal and anal systems of a specimen 1.9 mm. in length, magnified.
8. Specimen 37 mm. in length, seen from the actinal side.
9. The abactinal system of the same as fig. 8, magnified.
10. The anal system of the same specimen as fig. 8, magnified; it has the same number of anal plates in the outer row as in the young, fig. 7.

[1] Tripylus cavernosus Phil.





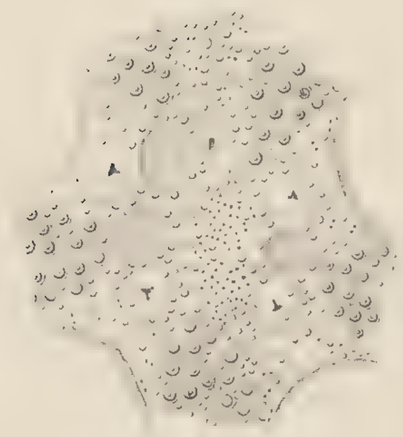


PLATE 100.

Plate 100.

1–5. **Schizaster Townsendi** A. Ag.; Station 3425.

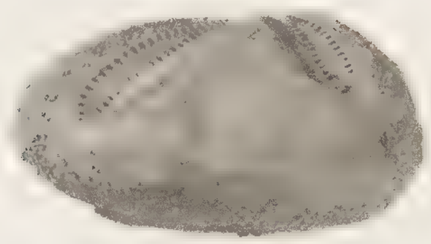
1. Young specimen 10 mm. in length seen from the abactinal side.
2. Specimen 40 mm. in length, seen from the actinal side.
3. The same as fig. 2, seen from the abactinal side.
4. The same in profile, seen facing the left posterior ambulacrum.
5. The same, facing the anal system and odd posterior interambulacrum.

6, 7. **Brissopsis columbaris** A. Ag.; Station 3394.

6. Specimen 48 mm. in length, seen in profile facing the left posterior interambulacrum.
7. The same, seen facing the anal system.

All figures natural size.

4



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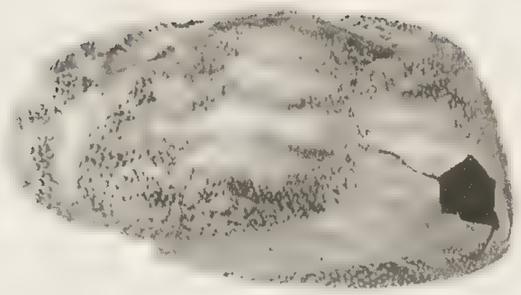

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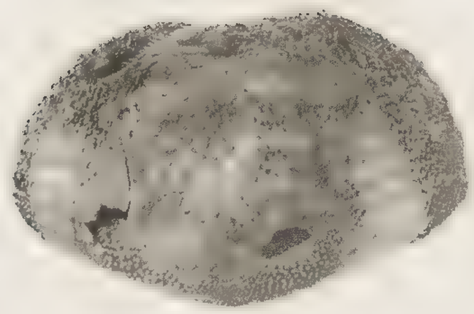
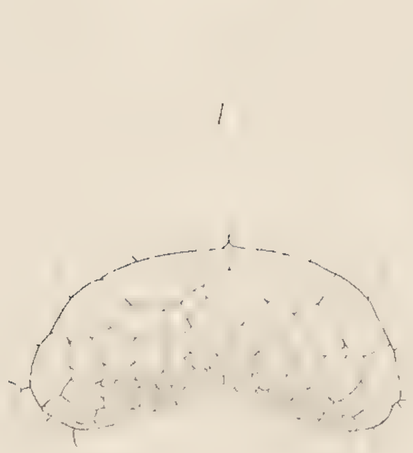


PLATE 101.

Plate **101**.

1–10. **Schizaster Townsendi** A. Ag.; Station 3425.

1. Seen from the actinal side, 40 mm. in length.
2. The same as fig. 1, seen from the abactinal side.
3. Abactinal system and surrounding plates of same specimen as fig. 2, enlarged.
4. Actinostome of same as fig. 1.
5. Anal system of same as fig. 1.
6. Small specimen 10 mm. in length, seen from the abactinal side.
7. The same as fig. 6, seen from the abactinal side.
8. Abactinal system of same as fig. 7, enlarged.
9. Actinostome of same as fig. 6, enlarged.
10. Anal system of same as fig. 7, enlarged.



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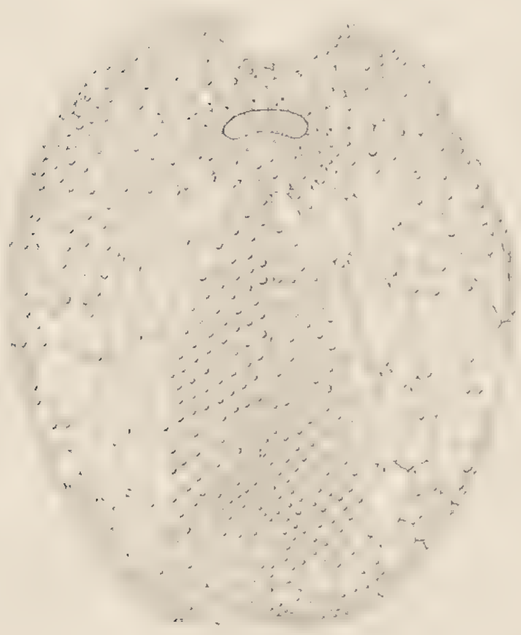

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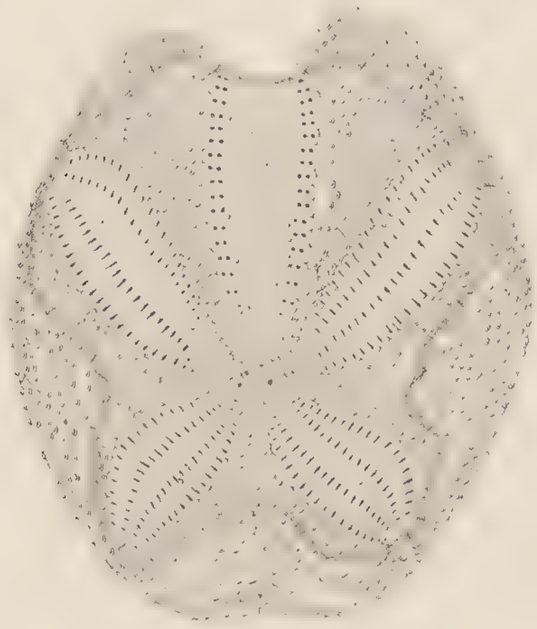

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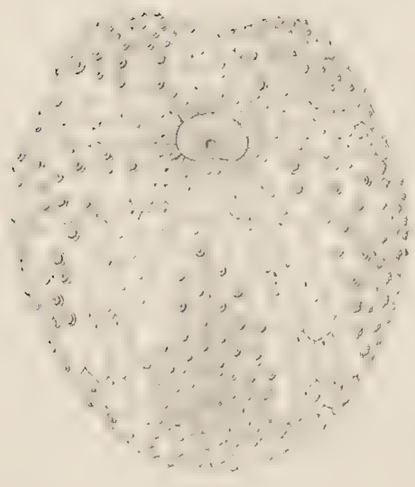

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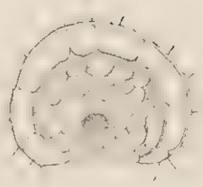

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PLATE 102.

Plate 102.

1–4. **Schizaster latifrons** A. Ag.; Station 3431.

1. Seen from the actinal side, 17 mm. in length.

2. The same as fig. 1, seen from the abactinal side.

3. Abactinal system and plates surrounding same.

4. Anal system and rudimentary fasciole of same.

5–9. **Brissopsis columbaris** A. Ag.

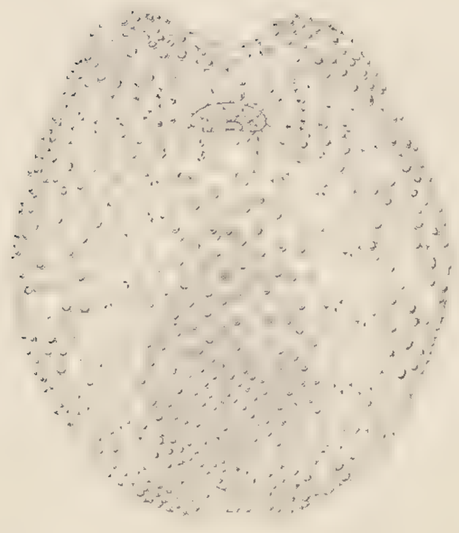
5. Specimen 22 mm. in length, from the abactinal side; Station 3353.

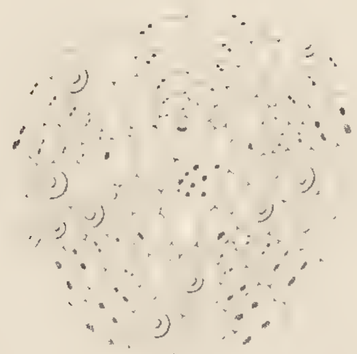
6. Actinostome and surrounding plates of specimen 48 mm. in length (Pl. 103, fig. 1) Station 3334.

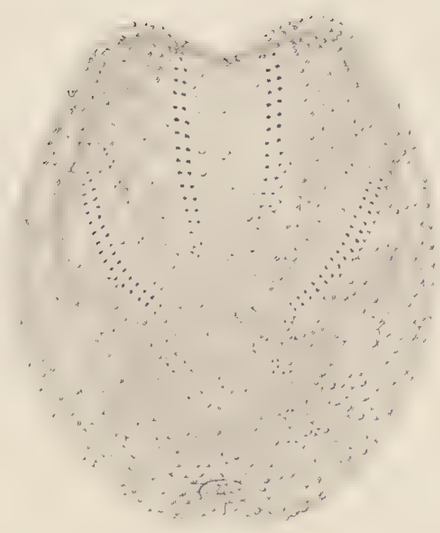
7. Abactinal system and surrounding plates of specimen 39 mm. in length, seen from the exterior; Station 3356.

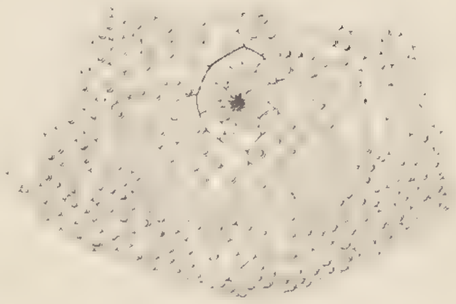
8. Anal system and fasciole of same specimen as fig. 5, 22 mm. in length.

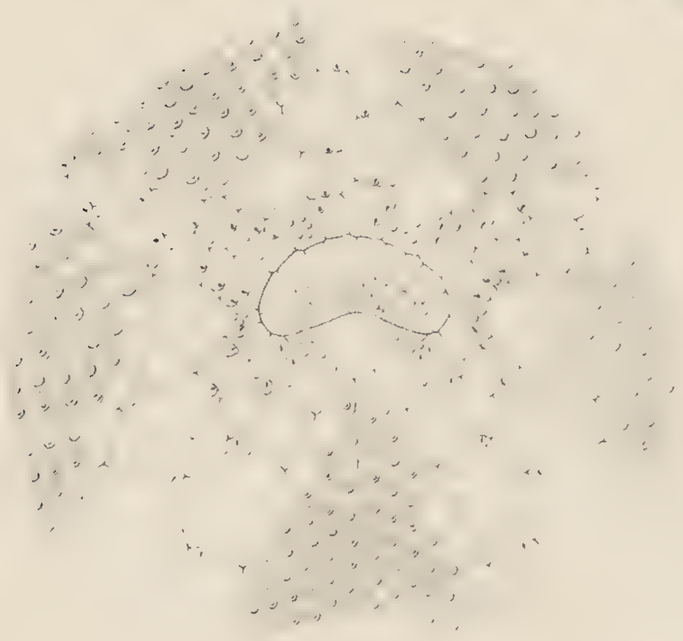
9. Part of anal fasciole of same specimen as fig. 7, 39 mm. in length.

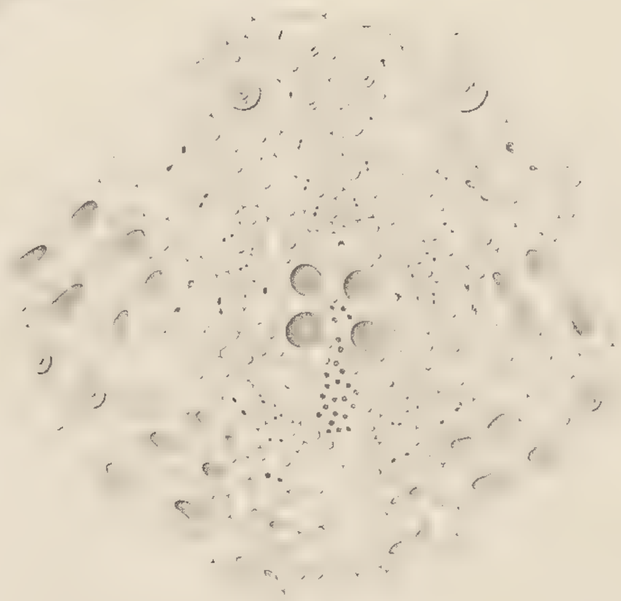


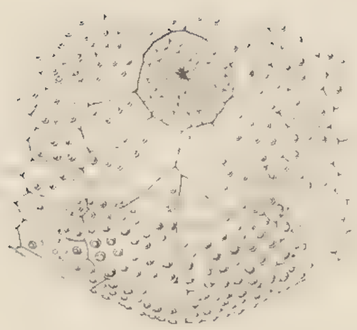












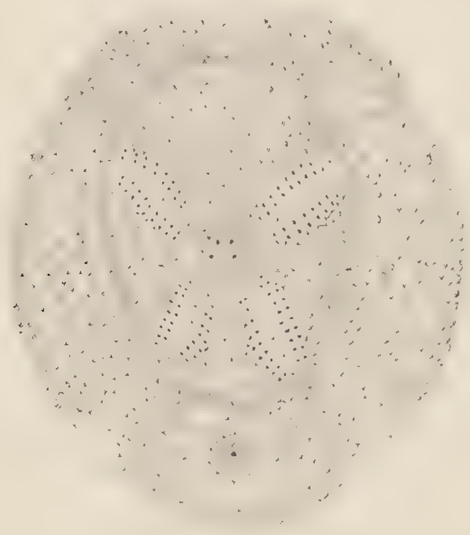


PLATE 103.

Plate 103.

1, 2. **Brissopsis columbaris** A. Ag.; Station 3394.

1. Actinal view of specimen 48 mm. in length, same as Pl. 100, figs. 6, 7.

2. The same as fig. 1, seen from the abactinal side.

3, 4. **Toxobrissus pacificus** A. Ag.; Station 3355.

3. Seen from the actinal side.

4. The same as fig. 3, seen from the abactinal side.

5–7. **Periaster tenuis** A. Ag.

5. Fragment, showing the actinal part of the test from the interior; Station 3399.

6. Fragment, showing the abactinal part of the test denuded; Station 3398.

7. The same fragment as fig. 6, seen from the interior.

All figures natural size.

PLATE 104.

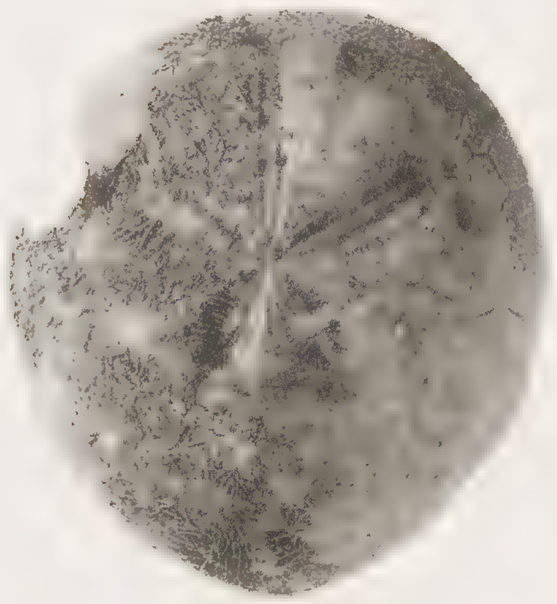
Plate 104.

1–5. Periaster tenuis A. Ag.

1. Specimen 58 mm. in length, seen from the actinal side, partly denuded; Station 3398.
2. The same as fig. 1, seen from the abactinal side, partly denuded.
3. The same, seen in profile facing the right posterior interambulacrum.
4. Another specimen, 67 mm. in length, seen from the actinal side; Station 3399.
5. The same as fig. 4, seen from the actinal side.

1

2



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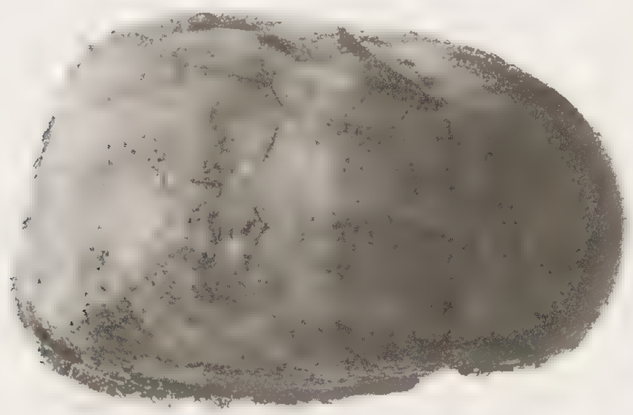

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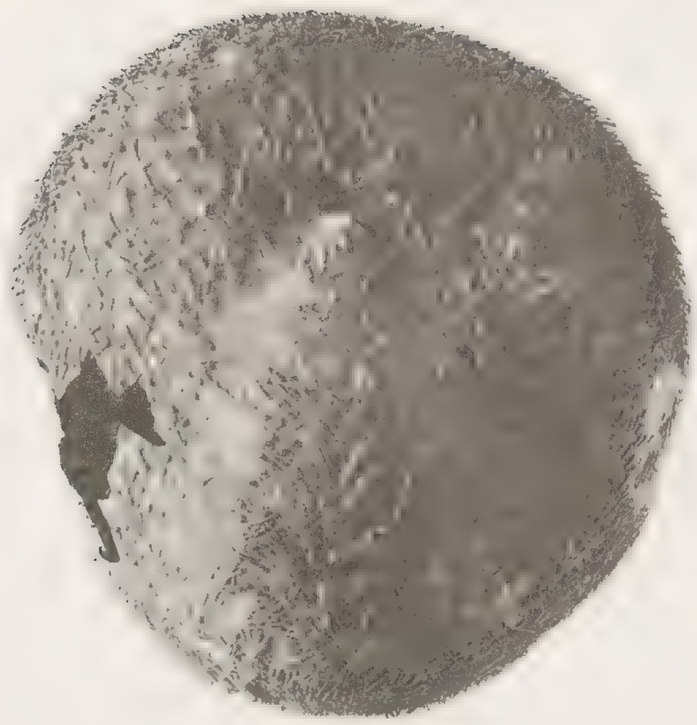

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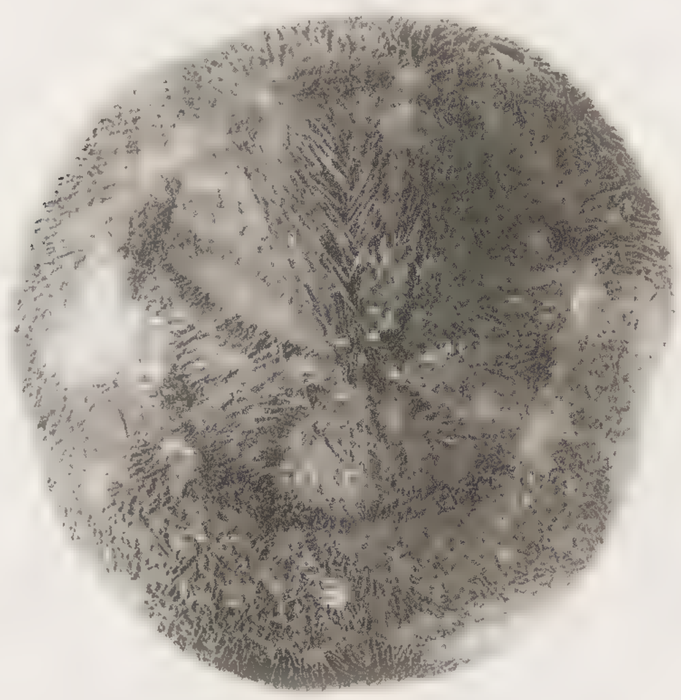


PLATE 105.

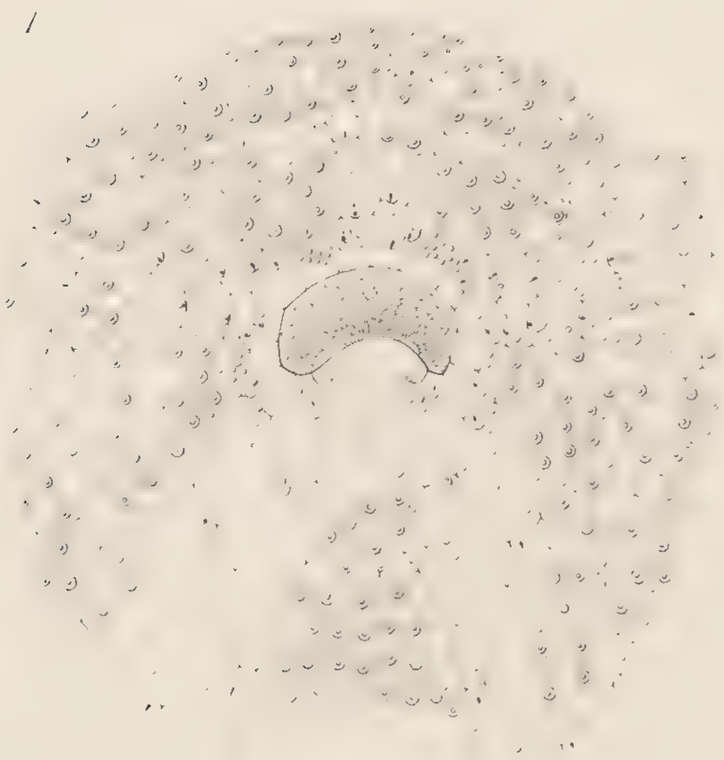
Plate 105.

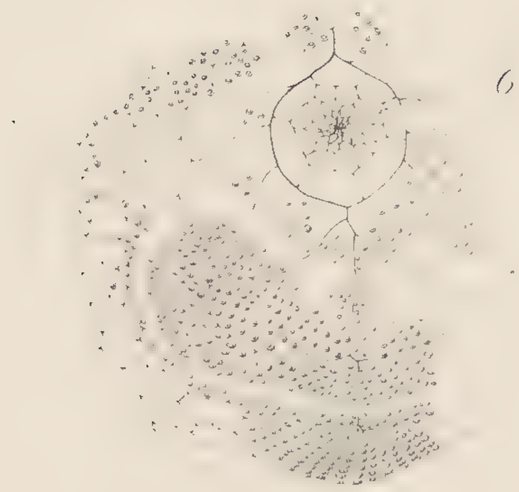
1–3. **Periaster tenuis** A. Ag.; Station 3398.

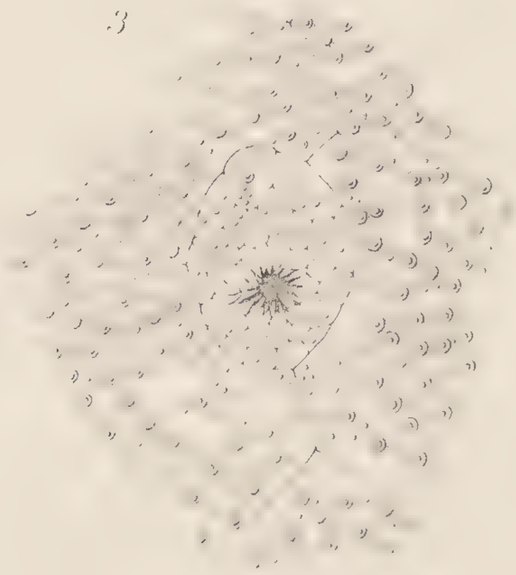
1. Actinostome and surrounding plates of specimen 58 mm. in length (Pl. 104, fig. 1).
2. Peripetalous fasciole and petals of specimen 58 mm. in length (Pl. 104, fig. 2).
3. Anal system of specimen 54 mm. in length.

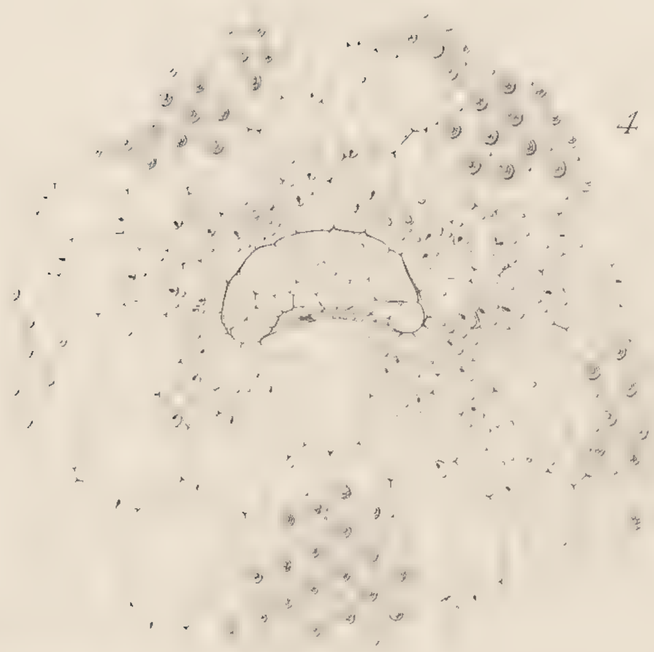
4–6. **Toxobrissus pacificus** A. Ag.

4. Actinostome and surrounding plates of specimen 50 mm. in length; Station 3357.
5. Abactinal system and surrounding plates of same as fig. 4.
6. Anal system and sub-anal fasciole of specimen 50 mm. in length; Station 3355.









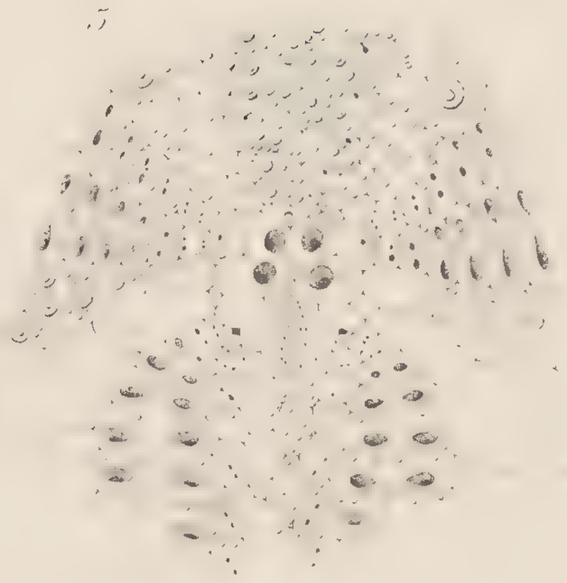


PLATE 106.

Plate 106.

1–4. **Spatagodesma Diomedæ** A. Ag.; Station 2769, "Albatross" Exp., N. Y. to San Francisco, off Cape Dos Bahias.

1. Specimen 5.3 mm. in length, developed from the actinal side.

2. Abactinal system of the same.

3. Anal system of same.

4. Abactinal system of same, seen from the interior.

PLATE 107.

Plate 107.

1–10. **Spatagodesma Diomedæ** A. Ag.; Station 2769, "Albatross" Exp., N. Y. to San Francisco, off Cape Dos Bahias.

1. Denuded specimen 5.3 mm. in length, seen from the actinal side.

2. The same, seen from the abactinal side.

3. The same, seen in profile, facing the left posterior interambulacrum.

4. Seen facing the anterior loop of the fasciole and the odd ambulacrum.

5. Seen facing the anal system and the odd interambulacrum.

6. Specimen 5.5 mm. in length, seen from the abactinal side, with its spines and suckers.

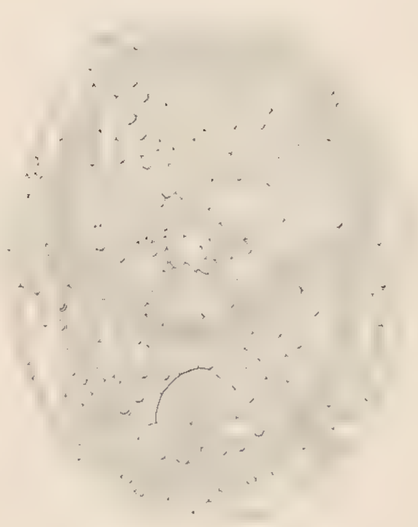
7. The actinostome and plates surrounding the same.

8, 9. Primary spines of the sternum.

10. Spines of the fasciole.

1

3



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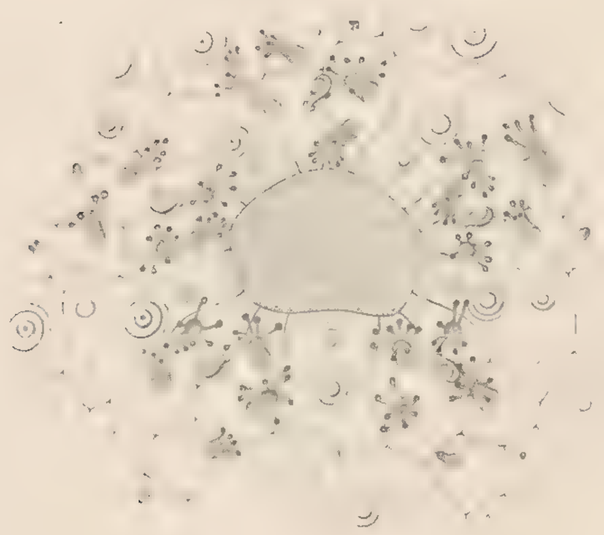

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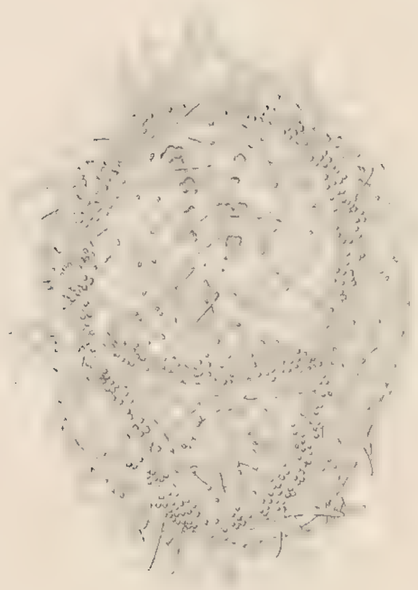


6

5

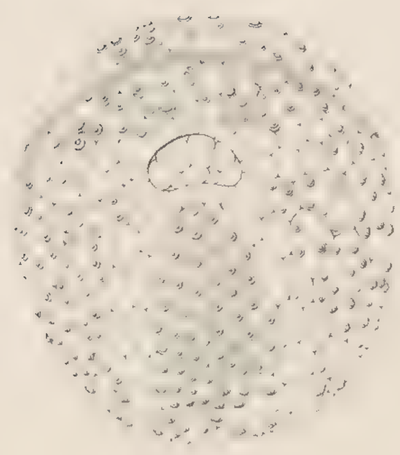
A M.Mesteruer d.

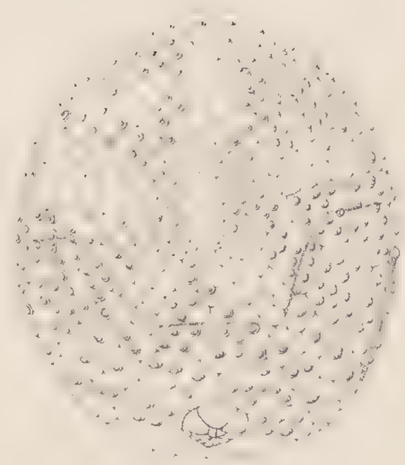
PLATE 108.

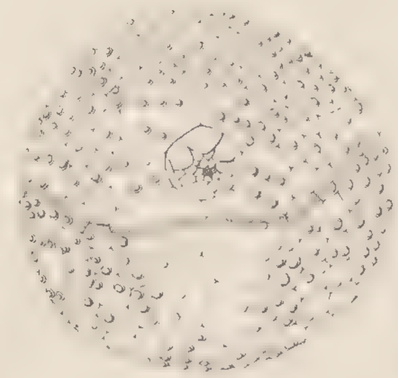
Plate 108.

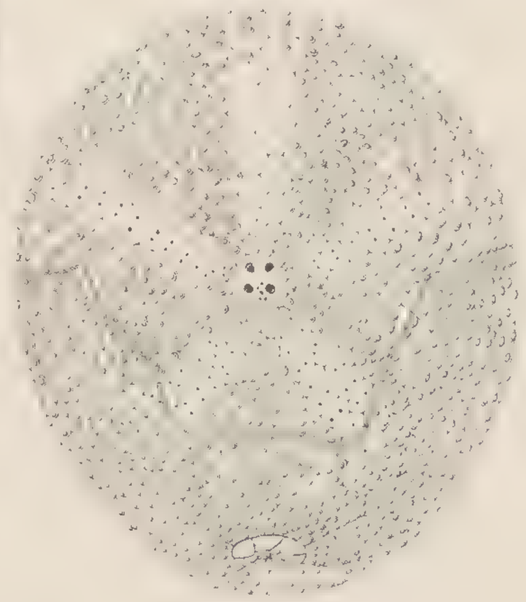
1–9. Agassizia excentrica A. Ag.

1. Young specimen, 5 mm. in diameter, from the actinal side; "Blake," 1878–79, Station 290, off Barbados.
2. The same, seen from the abactinal side.
3. The same, seen in profile, facing the left posterior interambulacrum.
4. The same, seen facing the anal system and the odd interambulacrum.
5. The abactinal side of the same, seen from the interior.
6. A specimen, 16 mm. in diameter, from the actinal side; "Blake," 1878–79, Station 231, off St. Vincent.
7. The same, from the abactinal side.
8. The same in profile, seen facing the left posterior interambulacrum.
9. The abactinal system and adjoining plates of the same, seen from the interior.









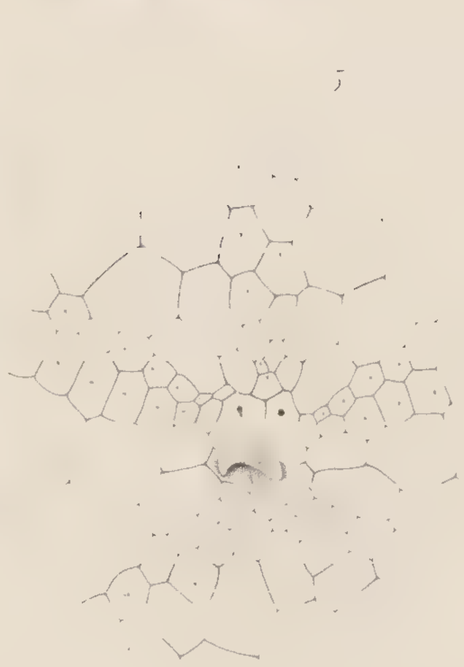


PLATE 109.

Plate 109.

1–8. Moira clotho A. Ag.

1. Specimen 34 mm. in length, seen from the actinal side; "Albatross" Exp., N. Y. to San Francisco, Station 2800, Bay of Panama.
2. The same as fig. 1, seen from the abactinal side.
3. The same as fig. 1, seen facing the left posterior interambulacrum.
4. Abactinal system and surrounding plates of specimen 31 mm. in length; "Albatross" Exp., N. Y. to San Francisco, Station 2801, Bay of Panama.
5. The same as fig. 4, seen from the interior of the test.
6. Fragment of interior fasciole along the left anterior interambulacrum of same specimen as fig. 4.
7. Actinostome of same specimen as fig. 1.
8. Anal system of same as fig. 1.

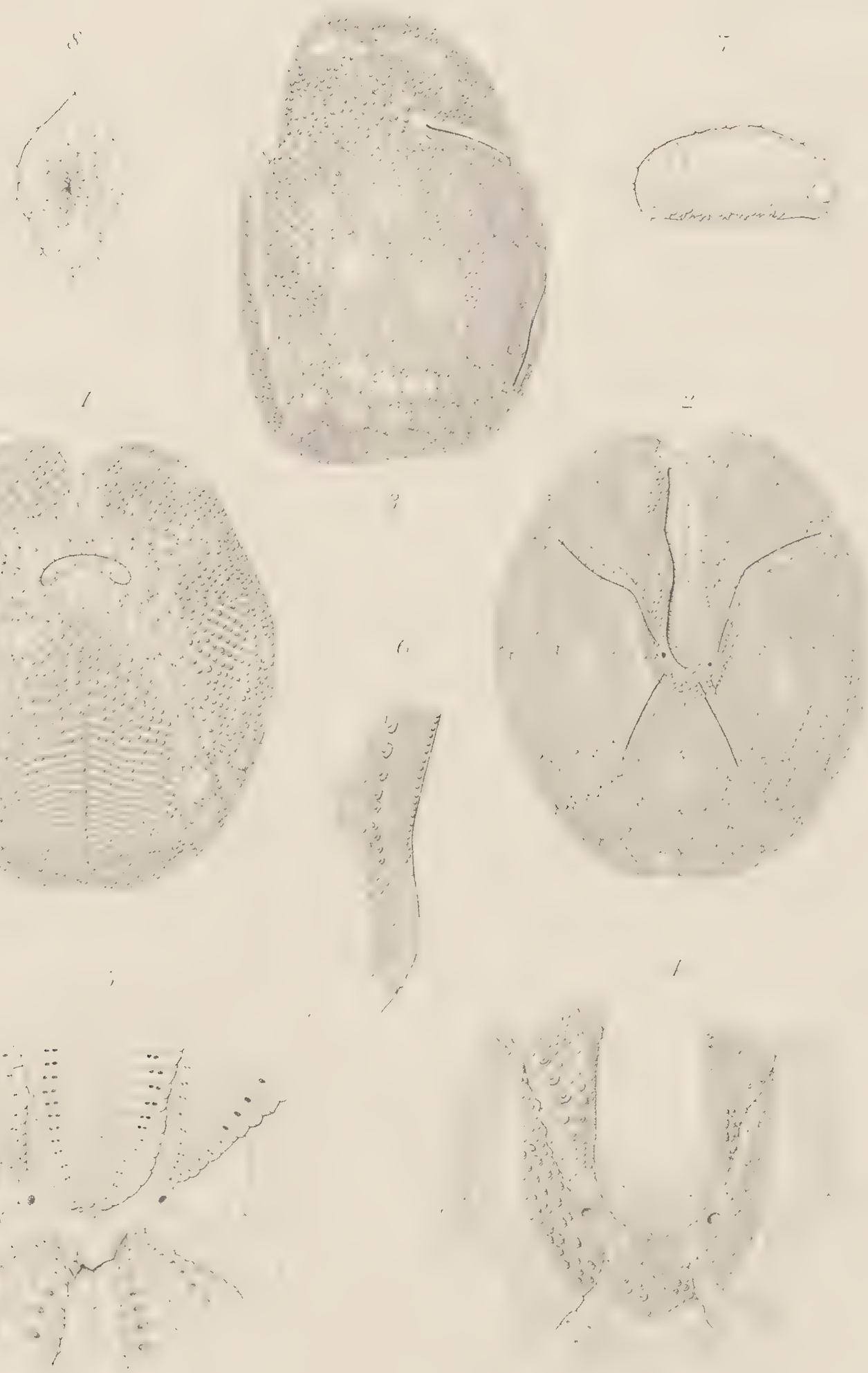


PLATE 110.

Plate 110.

Track of the U. S. Fish Commission Steamer "Albatross" during her trip off the West Coast of Central America to the Galapagos, to the West Coast of Mexico, and in the Gulf of California, in charge of Alexander Agassiz during 1891, Lieut. Commander Z. L. Tanner, U. S. N., commanding.

EXPLORATIONS OF THE
U.S.FISH COMMISSION
STEAMER ALBATROSS
February to April 1891
Lieut-Comdr. ZL Tanner U.S.N., Comdg
Compiled from the latest U. S. Hydrographic Office
Charts with additions by the U.S.F.C. Steamer Albatross
Soundings represented thus 27 Taken by the U.S.F.C. Str. Albatross 1888 1889 1891
100 fathom line shown thus
100 "
500 "
1000 "
1500 "
2000 "
Publishes reward. Geographical mark. Water. Sand. Shells
Specks. Gravel. Fine rock. Rock. Coral. Seaweed. Broken
Black. Red. Green. Brown. Dark. Light
Rock. Water
MEXICO
GULF OF MEXICO
GUATEMALA
HONDURAS
NICARAGUA
COSTA RICA
CARIBBEAN SEA
COLOMBIA
PANAMA
Gulf of Panama
GUAYMAS
Agiabampo
Topolobampo
Altata
MAZATLAN
San Blas
CORRIENTES
Manzanillo
Maruata
Petacalco Bay
ACAPULCO
P. Angeles
S. Jose
Corinto
Gulf of Fonseca
Gulf of Nicoya
C. Mala
Chiriqui
Chiriqui Lagoon
Chorro Bay
C. Corrientes
C. San Lorenzo
Port Pitt
C. SAN FRANCISCO
C. SAN LAZARO
C. SAN LUCAS
LA PAZ
Magdalena Bay
Margarita Bay
Concepcion Bay
Santa Cruz Bay
Refugio Cove
Turtle Bay
Bay of Vizcaino
PENVILLA
GIGEDO ISLANDS
Roca Partida
Socorro
San Benedicto
Clarion
Nocotto
Farallon Rock
Travels of the U.S.F.C. Str. "Albatross" 1891
GALAPAGOS
(Archipelago de Colon)
ISLANDS
Tower I.
Abingdon I.
Albemarle I.
Narborough I.
Culpepper I.
Wenman I.
Indefatigable I.
James I.
Barrington I.
Charles I.
Duncan I.
Gardner I.
Hood I.
Chatham I.
Bindloe I.
Seymour I.
Baltra I.
Barrington I.
Indefatigable I.
Albemarle I.
Narborough I.
Abingdon I.
Tower I.
Culpepper I.
Wenman I.

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